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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

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Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Thirty-third Annual Meeting, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY,
EAST BOSTON, MASS., Feb. 5, 1903.

Gentlemen of the New England Association of Gas Engineers: The Thirty-third Annual Meeting of the Association will be held at Young's Hotel, Boston, Mass., February 18th and 19th, 1903.

The first session will be called to order at 10 A.M., in Room 12, and members are urged to be on hand promptly, as each year finds it more difficult to dispose of the business presented in the time at our disposal. Members are requested to remit their dues to the Secretary before coming to the meeting, as this will save his time and reduce the chance of duplicate bills.

Application blanks for membership may be obtained of the Secretary, and may be sent in, when properly filled out and accompanied by the admission fee of $5, any time before February 17th, 1903.

The members will dine as usual Wednesday evening, February 18th, in the large dining room of the hotel. All friends of the Association are cordially invited to attend the meeting, whether they get a special invitation or not.

It has been suggested that an exhibit of educational and advertising matter used by the various companies would be of interest and value. If this meets with your approval, will you kindly send to the Secretary, *at once*, samples of flyers, cards, pamphlets, etc., that you may have found useful, so that they may be arranged in convenient form for inspection between the sessions of the meeting.

The following papers, short topics and questions have been sent in:

"An Electrical Disturbance in the Gas Industry," by Mr. D. D. Barnum, Worcester, Mass.

"Methods of Bill Collection," by Mr. S. E. Baker, Fall River, Mass.

"Experience with Incandescent Lighting," by Mr. A. F. Cooper, Exeter, N. H.

"Development of the Gas Distributing System of the Suburban Gas and Electric Company, in Revere and Winthrop," by Mr. A. B. Tenney, Revere, Mass.

"A High Pressure Line," by Mr. W. A. Learned, Newton, Mass.

"In the use of prepayment meters, what methods are adopted for comparing the returns of the money boxes with the actual registration of the meters?"

"Which system of purifiers is proving the more satisfactory, economical and reliable; four boxes with center seal or two boxes of extra depth?"

"What is the relation of Texas oil to the gas business at present?"

"How near to a gasholder is it safe to have a gas lamp?"

"What results have been obtained from the new generator fuels used because of the coal strike?"

"At what point in the works should coal gas and water gas be mixed?"

"Does a mixture of coal gas and water gas give a higher candle power than would be computed from the known proportions and candle powers of the component gases?"

LIBRARY OF CONGRESS
FEB 17 1903
SMITHSONIAN DEPOSIT.

"Of the gas used for lighting what percentage is used through incandescent burners?"

"What results have been obtained with gas oil in 'fixing retorts'?"

"A—How can the gas consumer be induced to read his own meter?"

"B—If he would do this would it not reduce the complaints of 'Big Bills'?"

Please note carefully the "Question List" and come prepared to give intelligent answers to these inquiries, as they are put in good faith, and deserve careful consideration by the meeting. Very respectfully,

N. W. GIFFORD, Secretary.

[OFFICIAL NOTICE.]

Tenth Annual Meeting, Michigan Gas Association.

MICHIGAN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
ANN ARBOR, MICH., Jan. 12, 1903.

To the Members of the Michigan Gas Association: The tenth annual meeting of the Association will be held in Battle Creek, Mich., on Wednesday and Thursday, February 18 and 19. The headquarters of the Association will be the Post Tavern. Good accommodations are assured to all those who apply in advance. HENRY W. DOUGLAS, Secretary.

[OFFICIAL NOTICE.]

Novelty Advertising Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF SECRETARY, DELAWARE, O.,
January 20, 1903.

The Editor of the Novelty Advertising Department, Mr. B. W. Perkins, of South Bend, Ind., desires to announce that his department is now open for contributions, to be presented at the Nineteenth Annual Meeting, which will be held in Cincinnati, March 18th, 19th and 20th.

This department should prove very attractive for the convention. Its success, however, depends largely upon the active co-operation of the members. It is, therefore, earnestly hoped that the fraternity will not be backward in sending advertising schemes to Mr. Perkins.

T. C. JONES, Secretary.

[OFFICIAL NOTICE.]

Wrinkle Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF WRINKLE DEPARTMENT,
ST. PAUL, MINN., Jan. 17, 1903.

This department earnestly solicits the co-operation of the fraternity for contributions, to be presented at the Nineteenth Annual Meeting of the Association, which is to be held at Cincinnati, March 18th, 19th and 20th.

The Editor will be pleased to receive contributions not later than February, 14th.

E. E. EYSENBACH, Editor.
Care St. Paul Gas Light Company,
St. Paul, Minn.

[OFFICIAL NOTICE.]

Wrinkle Department, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF THE WRINKLE DEPARTMENT,
721 Citizens Building, Cleveland, O.

To the Members of the Western Gas Association: The Wrinkle Department is now ready to receive contributions for the 1903 collection, and I would thank you to please send a sketch or description of any new device or method you may have to the above address.

Any sketch, photograph or drawing, accompanied by a written explanation, of a new idea will be gratefully received, and it is hoped that you will comply promptly by favoring us with a contribution.

Respectfully,
W. E. STEINWEDELL,
Editor Wrinkle Department.

BRIEFLY TOLD.

INSTALLATION OF PRESIDENT HUMPHREYS.—The formal installation of Mr. A. C. Humphreys as President of the Stevens Institute of Technology was brought off in Hoboken, the afternoon of the 5th inst. The inauguration took place in the Carnegie Laboratory of Engineering, which adjoins the main buildings of the Institute on Hudson street. The audience was a most distinguished one, and included Mr. Carnegie, who in a well put together speech, among other things said: "I think if Dr. Morton could have had anything to say about the appointment of his successor he would have made just this selection. The Institute could not have chosen a better man for his successor than Mr. Humphreys." The proceedings were dignified and replete with interest, and President Humphreys speech in acceptance and recognition of the honor put upon him was in his characteristic, forceful style. In the evening the Alumni Association of the Institute gave a banquet in honor of the new President, at Sherry's in this city. The proceedings thereat were under the direction of the President of the Association, Mr. W. S. Ackerman, and over 400 covers were laid. The galleries were filled with the wives and friends of the alumni. A great many representative gas men were present, and if we mistake not Mr. M. S. Greenough, President of the Cleveland (O.) Gas Light and Coke Company, represented Harvard College, and in the addresses responded for that institution. The proceedings were of the most interesting character, but their main significance to the gas fraternity was in the fact that one of their number had been elevated to a position of great prominence in the world of tuition, and the earnest hope of all is that President Humphreys' administration of the affairs of Stevens' Institute will be an unqualified success—and of that we have no doubt.

ANNUAL MEETING OF THE WISCONSIN GAS ASSOCIATION.—The second annual convention of the Wisconsin Gas Association was set for Feb. 11th and 12th, at the Hotel Pfister, Milwaukee, Wis., but we have received no telegraphic information respecting the sessions. Five papers were on the programme, and the social side of the gathering was to include an inspection of the new plant of the Milwaukee Gas Company, and a banquet on the evening of the second day in the rooms of the Milwaukee Athletic Club.

NOTES.—

WITH great regret we report the death of Mr. George B. Edwards, whose demise occurred the evening of Friday, the 6th inst., at his home in Jersey City, N. J. Deceased, who was in his 78th year, was very prominent in Masonic circles, and the major part of his business career was devoted to insurance affairs. He will, however, be best known to gas men from his connection with the firm known as the Goodwin Gas Stove and Meter Company, as Manager of its New York offices, originally located in the premises, 142 Chambers street. The funeral was held in Masonic Hall, Jersey City, the afternoon of the 10th inst.

CAPTAIN WM. H. WHITE sailed for Europe last Monday. The trip is taken solely for relaxation and sightseeing. He will return some time in May.

THE plan for the merging of the gas, electric lighting and street railway systems of Natchez, Miss., is completed to all intent and purpose. The passing over of the money is all that remains to be done.

AT the annual meeting of the Fort Wayne (Ind.) Gas Company the Directors elected were: C. F. Dieterich, A. E. Dieterich, Walton Ferguson, A. B. Proal, Geo. C. Clark, John Sloan, A. N. Brady, J. H. Benedict, Hugh Dougherty, H. C. Paul and C. S. Bush.

A "BILL" has been introduced in the New York Legislature which directs that no company supplying gas in New York city shall charge to exceed 70 cents per 1,000 cubic feet therefor. It won't "pass."

THE authorities of Westfield, Mass., which town operates a gas works on public account, have ordered that after April 1st the gross selling rate shall be put at $1.65 per 1,000, prompt payment (on or before the 15th of the month) to entitle the user to a rebate of 20 cents per 1,000.

THE Edison Electric Illuminating Company, of Boston, has purchased the plant and properties of the Natick (Mass.) Gas and Electric Company, and of the Framingham (Mass.) Electric Company.

THE proprietors of the Northampton (Mass.) Gas Company have arranged for the construction of a storage holder up to retaining 300,000 cubic feet.

MR. EDWARD J. BURKE, formerly Chief Clerk in the office of the Joliet (Ills.) Gas Light Company has accepted the position of Manager of the Marquette (Mich.) Gas Light Company.

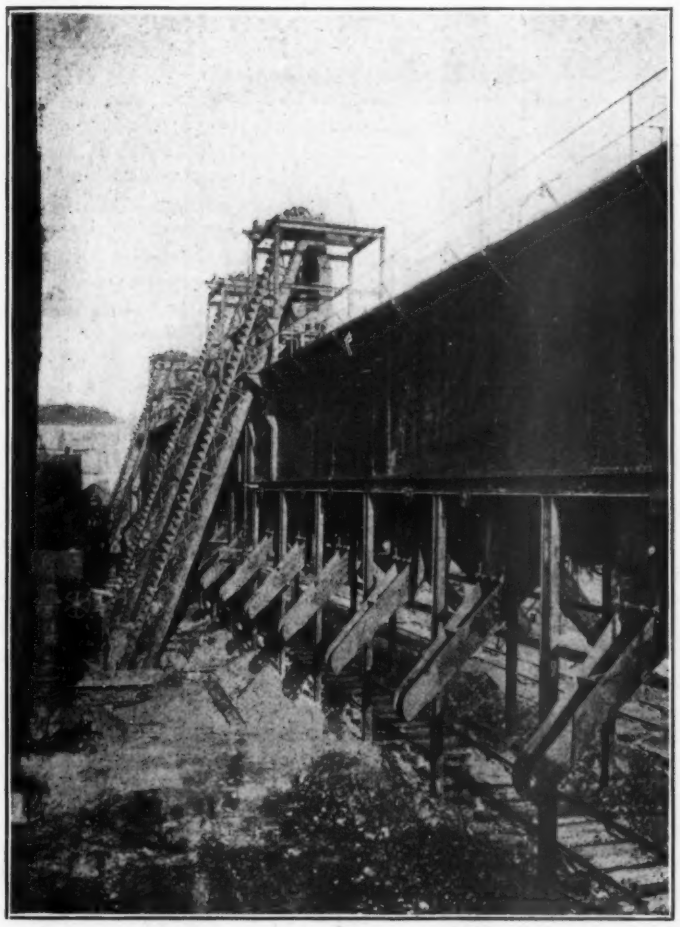
"W. H. T.," WRITING from La Fayette, Ind., under date of the 10th inst., says: "The Muncie Natural Gas Company and the Wabash Gas and Oil Company, of Muncie, Ind., have been consolidated under the title of the Muncie Gas, Light and Fuel Company, with a capital stock of $1,000,000. The new Company has in the neighborhood of 4,500 meter connections and expects in the near future to erect a plant for the manufacture of artificial gas for fuel and lighting purposes. The officers are: President, Chas. A. Neuper, of La Fayette; Treasurer, F. McKeen, of Terre Haute; Secretary, Robert H. Adams, of Indianapolis; Assistant Secretary, Chas. E. Rogers, of La Fayette.

[Concluded from Page 207.]

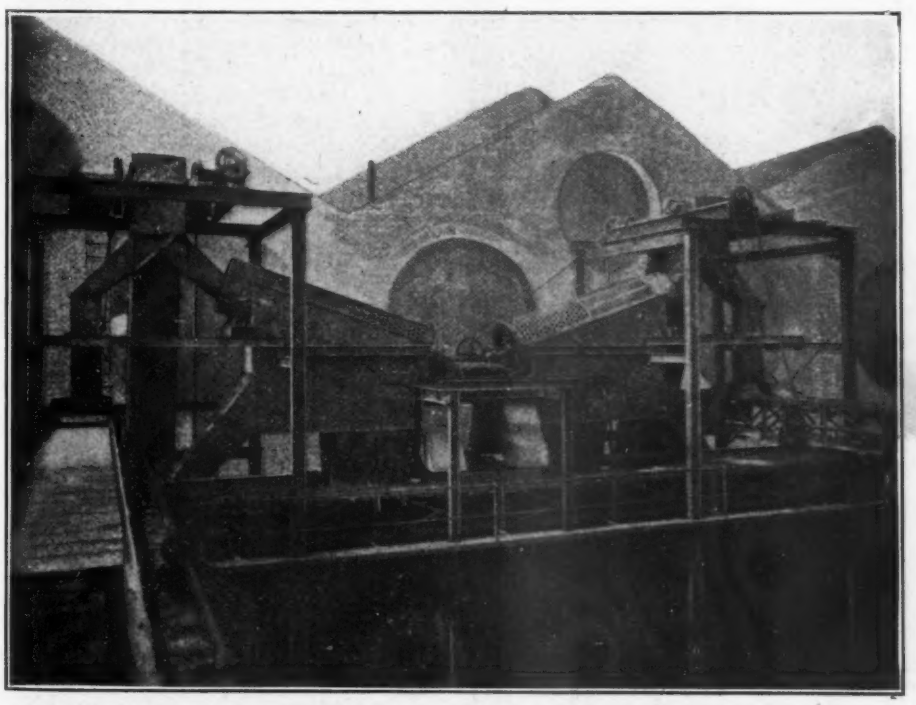
An English Inclined Retort Installation in Milan, Italy.

SECOND ARTICLE—THE COKE PLANT.

In conjunction with the installation of inclined retorts at the Milan works of the Union des Gaz (described and illustrated last week) is, as already indicated, a coke plant of quite noble proportions and capacity; and it needs to be both, seeing that it has to deal with the spent charges of the 32 beds of nine 20 foot retorts, and the older 16 beds of 15-foot retorts. The whole of the work, including the design, was entrusted to the same firm of contractors as the new inclined retort benches—Messrs. Graham, Morton, & Company, of Leeds. We have tried, by making a selection from the photographs taken as the work was approaching completion, to give our readers an idea of the site with which they had to deal. Looking at the photographs, it must, we think, be admitted that the scheme of the plant—both in its disposition and general character—is well adapted to secure the utmost service out of the area at disposal, that the designers have kept generously in view the extent and heavy nature of the work the plant will be called upon to perform, and that every section contains its points of engineering attractiveness. The pictures only bring before our view the outdoor plant; and there are the two long stretches of conveyors running through the new house, which, as already stated, is 254 feet 3 inches in length. It follows that there must be for the two conveyors in the house at least 500 feet of trough; and over 1,000 feet of chain, including the return. In addition, the contract included the fitting up of the pre-existing house with a conveyor, so that in all the firm laid inside the three houses about 750 feet of trough, and fitted 1,500 feet of chain. Remembering this, and viewing the extensive outside plant, the question of capital cost cannot fail to occur to one; but if in England it is found that such plant more than justifies its existence by the saving it effects in labor, how much more should it do so in a country in which a totally different measure is given as to what constitutes an honest day's work for an honest day's pay? Besides this, the severity of climatic conditions in Italy appeals to the humanitarian employers of labor in such operations as those of the retort house to take advantage of all means that will keep their men from exposure to excessive bodily fatigue and discomfort. Old Sol's rays, as we showed in our final remarks last week, beat down unmercifully on the retort house worker and the wheeler-out of hot coke in the summer time in the district of Milan, and yet the rigors of winter are even more intense than here. Thus, from all points of view, a coke plant must be a *desideratum* in most Italian gas works of any pretensions.



Photograph No. 1.—Coke Elevators, Delivering to Screens and Cross Conveyors.



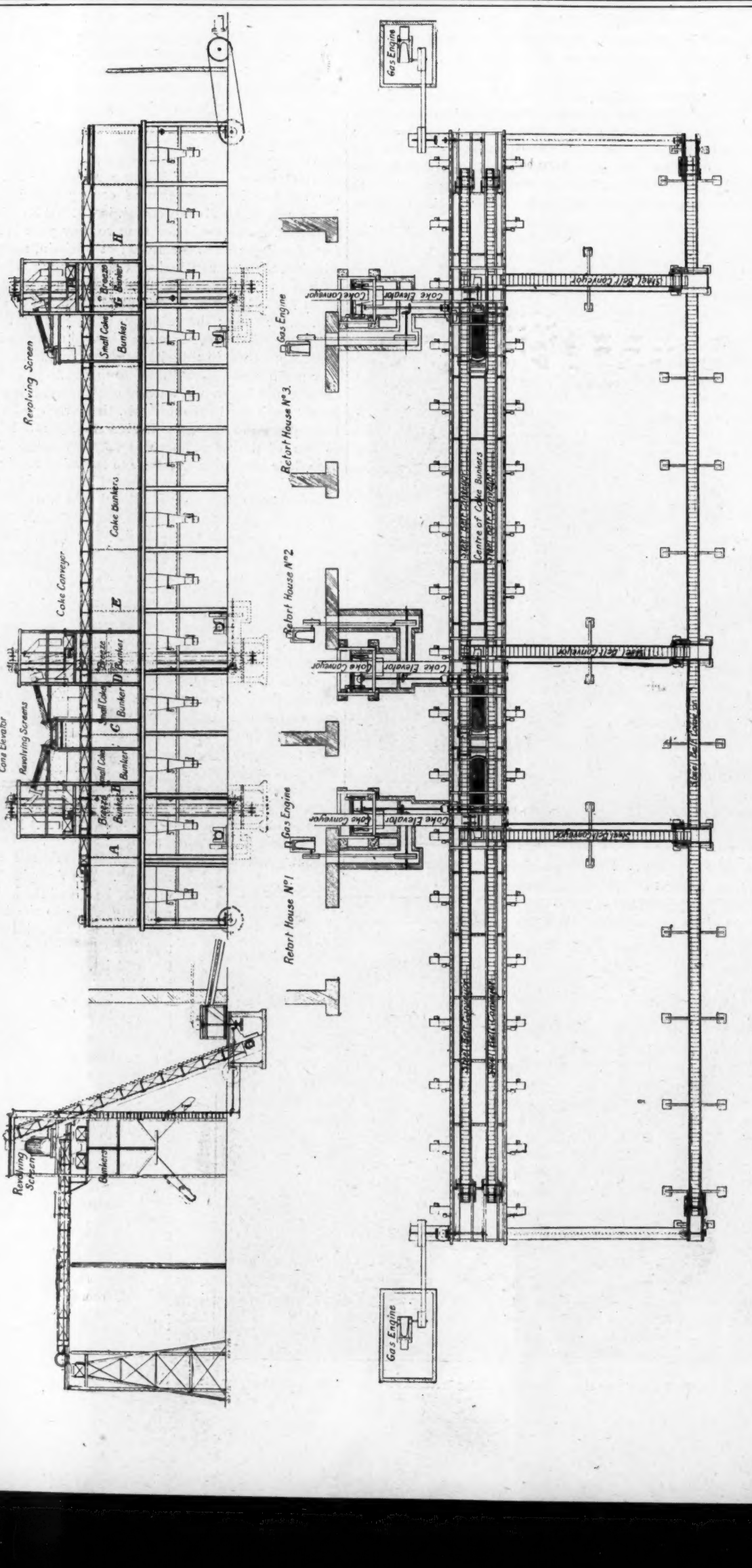
Photograph No. 2.—At the Heads of Two of the Elevators, Showing Breeches, Shoots, Screens, Cross Conveyors, etc.

But to return to the particulars that we have to give regarding the plant now being specially dealt with. In last week's article, it was stated that the hot coke conveyors in the houses are placed on a level with the clinkering floor; and good reasons for this were given. This position of the hot coke troughs in part contributed to another variant from the usual design of the first piece of the coke plant that is encountered on emerging from the retort houses. We say "partly," because a further element in compelling the variation was the limited site at disposal for the coke yard. It was at first hoped that it would have been possible to get sufficient space to carry an inclined conveyor from the retort house conveyors to fill the elevated storage bunkers; but this was found impracticable. Therefore, the inevitable course was to drop the coke into the boots of the elevators, and raise it by them to the screens, or to the cross conveyors for storage purposes. Although this is not such a convenient, straightforward, and compact arrangement as that generally adopted, it is not in this case a matter of very great moment. The dropping of the coke into the elevator boot, and the lifting of it in this manner, contribute to the breakage of the coke; but this is not regarded as detrimental, seeing that there is big demand for broken coke in the district. So it happens that here what might in some cases be a drawback is a point of little consideration. The variation named brought in its train two advantages of considerable importance. It enabled first a long line of 13 storage bunkers to be placed conveniently for the railway siding, and near to the gable ends of the 3 retort houses; and, secondly, it permitted of the yard storage conveyor being placed further out, which will have a beneficial influence in erecting further extensions.

This is the scheme of the coke plant in outline; but now we will examine it a little more particularly. As was previously mentioned, there are three hot coke conveyors. They are on Graham's patent, and are 243 feet centers. A few constructional details will be of interest. The trough is built of cast iron—the bottom plates being ¼-inch thick, with ribs 1-inch thick, the side plates ⅜-inch thick, with ribs ¾-inch thick, cast in lengths of about 4 feet.

All the faces of the various plates where they join together are provided with chipping

THE NEW RETORT HOUSE AT THE MILAN WORKS OF THE UNION DES GAZ.



Elevation, Section and Plan of the Plant Outside the Retort Houses.

strips; and the plates are securely bolted together, and made water tight—being well caulked with sal-ammoniac and iron borings.

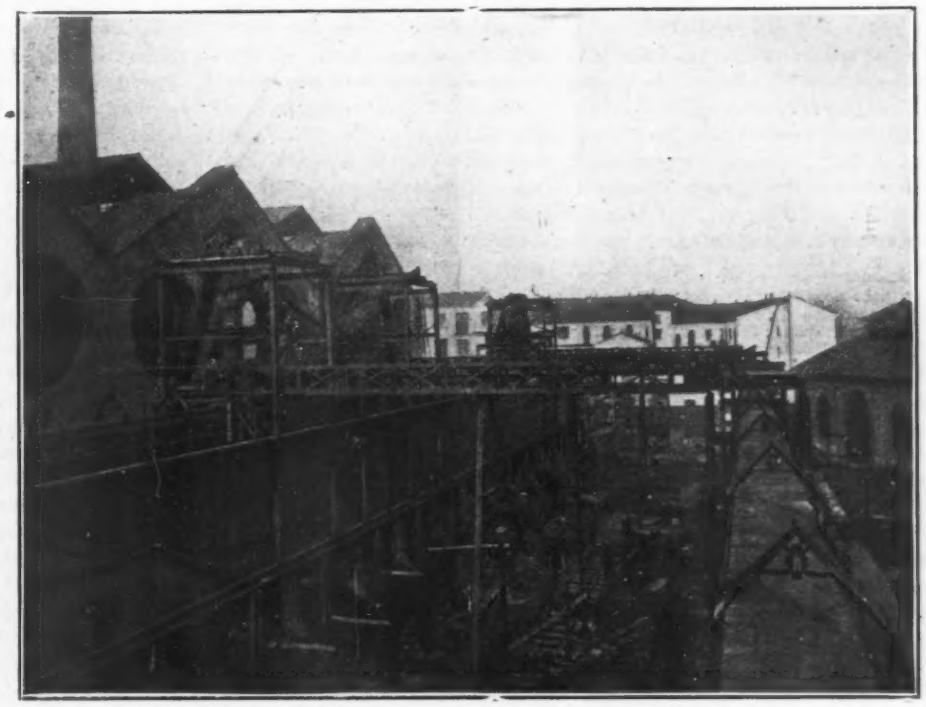
To the side plates running the full length of the retort house are bolted the deflecting plates for guarding the chain. These are secured by ¾-inch diameter bolts. There are two strands of steel chain to each conveyor; the chain being built up of manganese steel attachment links, with solid forged steel links each of 18-inch pitch, arranged in a suitable manner for giving a large wearing surface to the working points. Between each pair of links, and pitched 18 inches apart, are manganese steel rollers 4½ inches diameter, supported on forged manganese steel pins. Bolted to the two strands of chain as distance pieces, and also to act as scrapers, are 4-inch by 4-inch angle irons.

The trough is covered its entire length with chequer-plates, with removable sections where required; and attached to the chequer-plates is a narrow gauge railway, which carries the traveling shoot used for conducting the coke from the retorts to the conveyor. The return chain is supported from the underside of the drawing stage by angle iron runners. The driving end consists of two large hexagonal drums fitted with renewable steel teeth, and keyed on a 4½-inch diameter shaft, and is arranged at the end of the conveyor so as to allow the delivery end to be slightly raised in order to drain off any surplus water. There are two trailing shafts; and to each shaft is keyed a pair of drums, provided with large guides to keep the chain in position. The shafts are supported in bearings, which are provided with steel springs, in order to maintain an even strain throughout its working. At the end of each conveyor is arranged a shoot for delivering the coke into its respective elevator.

The three elevators (which are seen in photograph No. 1) are on the continuous bucket principle, with buckets 24 inches wide. The height of the elevator center to center of the sprocket wheels is 59 feet 5¼ inches. These elevators consist of a lattice built up framework, containing four 3-inch by 3-inch angle iron runners, with stanchions of similar section; the frame thus formed being well braced by 2 inch by ⅜-inch flat steel bracing, so as to form two substantial side girders, which are attached to one another by means of a back plate, which also guards the buckets on their return side. The four angle iron runners are provided with greenheart wood liners, which are secured by countersunk bolts to the angle runners. The boot of the elevator consists of two steel side plates effectively stiffened by means of angle irons, and carrying an angle iron frame, which supports the bottom shaft, so that the shaft may be varied. The receiving hopper which is attached direct to this boot is provided with an improved form of flap-door feed, which is so arranged as to automatically fill each bucket with coke as it moves forward. The top framing is finished off in a similar manner to the casing, and is provided with a breeches shoot for delivering the coke either into the screen or on to the cross belt conveyors, which carry the coke to the storage conveyor in the yard.

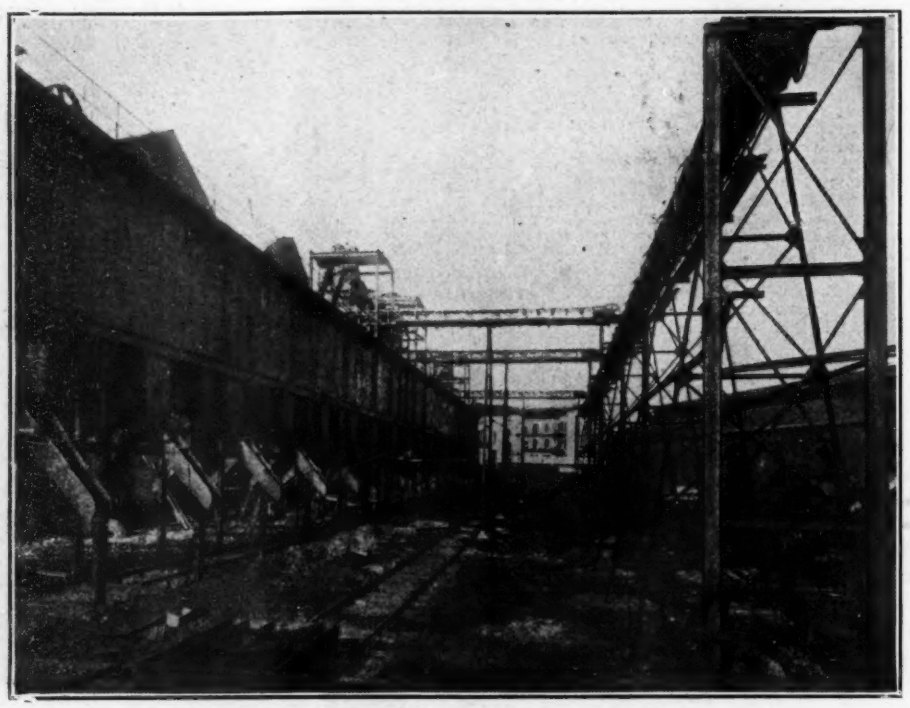
The top and bottom shafts are each 3½ inches in diameter, with two sprocket wheels keyed on each; the top shaft being supported in pedestals, and the bottom shaft in adjusting blocks, which are arranged with an adjusting screw for varying or adjusting the length of the elevator center to center so as to correspond with the pitch of the chain. Over the top and bottom sprocket wheels are stretched two strands of 12-inch pitch steel roller chain, each link of the chain being arranged with a special ear, to which the buckets and skidder bars are attached. The buckets are pitched 12 inches apart, and overlap one another, so as to present a continuous surface of plate when the bucket receives the coke—thus preventing any small material from falling into the working portions of the elevator. The buckets are also arranged so as to give a perfect delivery of the material when discharging.

Photograph No. 3.—Steel Belt Conveyors over Coke Bunkers.



Photograph No. 4.—A General View of the Plant from Above.

The screening plant at the head of the elevators and above the storage bunkers are also very clearly illustrated in photograph No. 2. As will be seen, they are on the rotary principle, and are 12 feet long over all, and 3 feet in diameter. The screens are built of perforated steel plate, the upper portion being perforated with 1-inch diameter holes, and the lower portion with 3-inch holes; the plates being rolled so as to form a cylinder, which is stiffened by T-irons and angle iron rings. Internally, there are also fixed two centers, which support a 3½-inch diameter shaft, the shaft projecting through, supported, and revolving in an inclined footstep, which is brass bushed and provided with steel wearing pads at the bottom. The upper portion of the screen is supported by two roller bearings, as by this means the end of the screen is kept perfectly clear, and a good discharge is obtained from the elevator to the screen. At the lower end of the screen is bolted a bevel wheel ring, and the motion is transmitted to the screen by means of a bevel pinion 9 inches in diameter. Under the screen are arranged the shoots for delivering the breeze and small coke into the respective coke bunkers, the large coke being delivered on to the steel belt storage conveyor.



Photograph No. 5.—A General View of the Plant from the Ground Level.

These belt conveyors, which are placed directly over the storage tanks, are 2 feet 6 inches wide, with 231 foot 5½ inch centers. [See photograph No. 3.] As in their general structure they are in every respect similar to the three cross conveyors [photograph No. 4] feeding on to the yard distribution conveyor [photograph No. 5], and to the latter itself, we may describe them together, with the preliminary statement that the distribution conveyor is 237-foot 4½-inch centers, and is supported on trestles, and the cross conveyors are each 50 feet 5½ inches long. The cross and distribution conveyors are 30 inches wide. Each conveyor is built up as follows: There are two lattice braced girders, forming the two sides of the conveyor, composed of 3-inch by 3-inch angle steel runners, with 2-inch by ⅜-inch flat steel lattice bars, and 3-inch by 3-inch angle iron stanchions, the ends being carried forward so as to support the driving and trailing ends respectively. The two girders that are thus formed are attached to one another by means of cross bars and lattice bars, so as to form a rigid framing. Attached to the angle runners both top and bottom, are filbows supporting 1¼-inch diameter steel shafts, with 6-inch diameter rollers, these rollers being used for supporting both the carrying and the return chain respectively.

The rollers are arranged three feet apart, and support the conveyor plates clear of the angle-runners. The driving and trailing ends are built up of channels attached to the angle-iron runners, so as to form a self contained frame; the trailing shaft being arranged with adjusting gear for regulating the length of the conveyor. The end shafts are each 3½ inches diameter; and each shaft is provided with two massive hexagonal drums suitable for 12-inch pitch chain. To each of the end shafts is keyed a 3-foot 6-inch diameter spur wheel, driven by means of an 11-inch diameter pinion, mounted on a 3-inch diameter countershaft. This gear is arranged on each end of the conveyor, so that it may be driven in either direction when required, thus conveying the coke to any position in the storage bunkers. When it is remembered that there are three distinct inclined retort benches—two benches of 16 beds of nine 20 feet retorts, and one bench of 16 beds of 15-feet retorts—it will be recognized what an important matter this reversing of the conveyors is, and how it will facilitate the filling of the exhausted bunkers and the distribution of coke to the most convenient parts of the storage yard when the bunkers happen to be full. But to proceed with the description. There are two endless strands of 12-inch steel linkwork stretched over the end drums. This chain is of a special design suitable for being driven in either direction; the teeth of the hexagonal drums being arranged so as to engage with the chain in whichever direction it is required to drive it. Attached to this double strand of chain are ¼-inch steel plates, 2 feet 6 inches wide, joggled so as to overlap one another, as, by this means, they present a continuous travelling surface or tray.

Along the length of the storage or distributing conveyors are provided steel ploughs, 12 feet pitch; these being arranged in such a manner that they may be put to work with the greatest ease, or may be thrown out of gear as required. The ploughs consist of specially curved and bent plough blades fastened to a V-iron; the curve in the plates being so arranged as to push or plough the coke off the conveyors into the coke tanks or the yard. Along the whole length of the distributing conveyors is arranged a gantry of $\frac{5}{16}$-inch steel chequer plate, 2 feet wide, complete with hand railing and ladders.

The trestles are about 33 feet high, built up of two stanchions; each trestle consisting of two lengths of 3-inch by 3-inch by ⅜-inch steel angle, placed back to back, riveted together, arranged with four gusset plates, to which the cross bars and bracing are attached.

The cross bars are of 3-inch by 3-inch angles, and the lattice bars or cross bracing 2½-inch by ⅜-inch flat. The foot of each leg of the trestle is supplied with a good stout foundation plate, which is attached to the legs by means of gusset plates and cleats. The upper portion of the trestle consists of two 6-inch by 3-inch channels, placed back to back, on which are fixed the conveyor and gantry. These trestles are 13 feet 9 inches wide at the bottom, tapering to 3 feet 6 inches wide at the top. The ends of the storage conveyors and the three cross conveyors are supported on trestles built up of rolled steel joist, and each of the three elevators and screens is supported in a similar manner by joist columns, well cross-braced.

The coke storing bunker, which forms such a prominent feature of the outside plant, requires little in the way of description; but it raises other points of interest. It will be a sufficient description to say that the bunker is 252 feet long, 12 feet wide, and 14 feet deep, arranged so as to deliver the coke on either side. Six portions of this bunker are divided off for the small coke and breeze; the remainder being used for the storage of the large coke. The sides are of ¼-inch steel plate, and the bottom of $\frac{5}{16}$-inch steel plates. The side and bottom plates are well stiffened by means of angle irons, T-irons and bracing; the bottom of the hopper being arranged so as to deliver the coke on either side. The bunkers are supported on rolled steel joist columns, spaced 14 feet apart. Also pitched 14 feet apart on each side of the bunkers are specially designed hinged shoots for filling baskets with coke (as is the local custom) or carts in bulk. At the same time railway trucks can be filled from beneath the bunkers. But in connection with the railway trucks, we may make an interesting little pause. Their great diversity in design and size had to be allowed for in planning the new plant. The variety, as anybody is aware who knows anything about Italian rolling stock, is its peculiarity, and only such can fully appreciate the difficulties to be faced and realize how impossible it is to expect to secure the equal automatic filling of all the different kinds of trucks used. Some of the trucks have still the old-fashioned guard seat at the end, and therefore the height—varying as much as 8 to 14 feet—is too great to allow of the same arrangements in regard to filling as are common in England. Then there are many railway trucks of about 18 tons capacity, the only means of filling which are small doors opening outwards in the middle.

The covered fruit trucks are also used for other than their legitimate purpose out of the season; and the totally dissimilar service of conveying coke is frequently their portion. These fruit trucks are more difficult to supply with coke than any of the others. The only means of access is by way of a sliding door covering an opening in the middle of the side of the trucks; and therefore all the coke falling into that door has to be raked to the end of the truck away from the opening. Manifestly this means the expenditure of much more labor and time than would be taken in the filling of ordinary English trucks. These are only examples of curious charactered wagons, to cope with which special means had to be devised. The task of providing for all these types of conveyances had its difficulties; but so far as they were conquerable they have been met. It was arranged that small 10-ton open trucks should be supplied with coke from the openings underneath the bunkers; and, as there are three distinct lines of rails, three different sizes of trucks can receive their supplies at the same time. Incidentally, it may be mentioned that special attention has also been given to the permanent way, so as to enable horses and carts to pass over it and receive their supply from the bunkers without undue fatigue and trouble.

The power used for driving this large coke plant is gas. Each set of hot coke conveying plant, elevators, and cross storage conveyors is regarded as a unit; and for this reason each has its separate gas engine. There-

fore, in this connection there are three engines of 35-brake horse power, and of Messrs. Crossley's make. These engines are suitably located and protected in the retort house between the end of the benches and the gable wall. The power is transmitted from the engine by means of belt pulleys to a primary or countershaft. From this countershaft the power is transmitted to the hot coke conveyor by means of a small vertical shaft and gearing. The power for driving the coke elevator with its respective screen and cross conveyor is also taken from this same primary shaft, by means of a vertical shaft with direct gearing. For driving the storage conveyors, there are two 45-brake horse power gas engines —one placed at each end of the yard; these being arranged so that any of the three storage conveyors may be driven in whatever direction is required, the conveyors being reversible. Each engine is capable of driving two of the three conveyors in the one direction; and by this means it can always be arranged that these long conveyors are driven from their delivery and not from the receiving end. The power from each engine is transmitted by belt gearing to the primary countershaft; and from this countershaft the power is taken by a vertical shaft to the respective conveyors.

This completes the description of the new coke plant at the Milan gas works, and it indeed forms an interesting supplement to the article published last week on the large installation of inclined retorts. We hope that these new works at Milan will yield the good returns anticipated; under fair conditions, there is no apparent reason why they should not. The alacrity with which the contractors handled the entire work so far from their center of operations was a commendable feat; and it is pleasing to record the fact that the gas company has already taken over the entire plant, and is now responsible for its proper working. We think, therefore, that Messrs. Graham, Morton & Co., Ltd.—and in particular the active head of the firm, Mr. Maurice Graham—are to be complimented on the successful issue of their efforts in carrying out such an extensive contract in the face of considerable dimculties and limitations of time.

Removing Naphthaline and Cyanogen from Gas.

[Abstracted by MR. FREDERIC EGNER.]

Herr Ritzinger, Engineer of the gas works at Kaiserslautern, Germany, writes entertainingly in the *Journal für Gasbeleuchtung* of the 17th ult., about the installation and management of a washing plant for the removal of naphthaline and cyanogen from illuminating gas, from which we make the following abstract: Herr Ritzinger declares that even the shade from a row of trees over a gas main was sufficient to cause deposits of naphthaline at that point in certain seasons, and that appearances of corrosion in the gasholders, caused by cyanogen in the gas, became fairly appalling. Consequently they decided to put in a washer in the attempt to remove both of the named troubles. The apparatus is nothing more than a machine of the standard washer type, but which from its description we presume is on the order of the "Mitchell" modification of that type of machine. It is stated that by reason of great difficulty in the way of placing this machine according to instructions (presumably those of Dr. Bueb, of Dessau, who is the inventor of the system), they were obliged to place it following the condensers. In a cut accompanying the description the sequence of apparatus is shown as follows: The gas from the retorts passes, first, through coolers or condensers, then the exhausters, next, a Pelouze tar extractor, after which follows the naphthaline-cyanogen washer, and finally the ammonia scrubbers from which the gas passes on to the purifiers. In the writer's opinion, it would have been better if the gas from the retorts could first have passed a hot tar scrubber, *then* the exhausters, after which in the order given above; but as Herr Ritzinger gave his reasons for setting his apparatus as described, it is not to be supposed but that he also would have made other arrangements could he have done so. Herr Ritzinger explains that, through being obliged to place the washer after the condensers, considerable of the cyanogen contained in the crude gas was lost, the loss amounting to something like 39.4 per cent. "On the other hand," Herr Ritzinger says, "by our arrangement of the apparatus a good deal of naphthaline is removed from the gas before it reaches the washer, and therefore does not need to be removed at that point."

The temperature of the apartment in which the washer is located is aimed to be kept at about 80° F., and the machine makes one revolution every 45 seconds.

The scrubber, or washer, has six compartments, the first two of which are filled with anthracine oil, to catch the naphthaline, the other four being charged with a solution of copperas to absorb the cyanogen; but the partition between the oil and copperas wheels is made somewhat higher than the others, to prevent the slopping over of liquid from one to the other; or the oil sections may be kept at a lower level of liquid to accomplish the same object. The oil used absorbs 20 per cent. of its own volume of naphthaline. It could perhaps do better, but they do not want to take chances, consequently when the first chamber of the scrubber indicates, by means of a simple test, that percentage of naphthaline its contents are removed, the second chamber's contents are pumped over into the first, and the second chamber receives a fresh supply of oil.

The copperas solution is made by dissolving the copperas in warm water, and up to a strength which will show 20° B., when it is collected in a storage vat until wanted.

According to Dr. Bueb, when this liquid is placed in the scrubber, it comes in contact, in the fourth or last chamber, with gas practically free from cyanogen, and is there converted, through the sulphuretted hydrogen and ammonia in the gas, into sulphate of iron and ammonia sulphate. Unless carefully watched, this procedure will lead to disagreeable stoppages in the scrubber passages and outlet pipe. Consequently it is well to clean out the apparatus from time to time and not to wait until this action becomes imperative. The actual absorption of cyanogen begins in the third chamber and continues in each of the following, until the finished sludge contains about equal to 11 to 12 per cent. of Prussian blue. At the works mentioned, and in their apparatus, the liquid is pumped from chamber to chamber after the passage of about 350,000 cubic feet of gas, while the contents of the fully charged one are withdrawn. This repumping takes about 7 minutes throughout. Most sensitive portions of the apparatus are the water gauge fixtures, which corrode rapidly unless kept very clean; it is well to flush them out with clean water after each test is made. It seems to the translator that right here is a point for some ingenious Yankee to get to work his inventiveness, and probably it will not be long before that objection to the Bueb washer will be effectually overcome. After some more detail, which applies mainly to German conditions, the author concludes that while the net profit from this manipulation is nil, there are such satisfactory reasons for the use of the Bueb scrubber that they would no longer wish to do without it; and he believes that the larger works also will soon see the advantages to be derived from it to the point of adopting it in their operations.

The Lighting of Some Indian Cities.[1]

By MR. A. J. KENNEDY, F.R.G.S.

Travelling recently through one or two Indian cities, on my way to the Durbar at Delhi, I jotted down a few impressions on the subject of private and public lighting which may interest your readers.

Madras.—Very remarkable from this point of view is Madras. The oldest city in India, it stretches for 9 miles along the Bay of Bengal; and if we include its suburbs it extends for 3 miles inland. For lighting purposes the municipality levy a rate which brings in about $22,500 per annum—a very small amount, it will be agreed, for the lighting of an area of about 27 square miles. All the artificial lighting is done by means of oil lamps, of which some 6,000 are in use. The lamps, with their 1¼-inch wicks, are fixed in square lanterns of ancient design, on the top of iron lamp posts, also of old pattern. In the less important thoroughfares the lamps are about 150 yards apart. In the principal thoroughfares, and there are only a few of these, the distance between each lamp is less, and at the junctions of cross roads the lamps are more numerous. I need hardly say that the city is badly lighted. I had a chat with the chief engineer—one of the most courteous of men, and a Britisher—and I learnt from him that the authorities are quite alive to the condition of affairs in this regard, and that estimates for improved lighting have been received from time to time, but they could not be entertained owing to the want of funds. For that reason the matter is shelved for a time.

There is an electric tram system working in the city, but not on an extensive scale. It is carried on by an English Company, called the English Construction Company, two-thirds of the shares being held by the folks at home and the remaining third locally. It is wonderful what an amount of English capital is invested in various undertakings in towns I have passed through—very often money entirely lost, as in the gold mining district of Thames, in New Zealand. The electric company in Madras pay a fair dividend. There are no omnibuses available and very few rickshas, and those that are on the road are wretched vehicles and badly manned. There are several very good shops, carried on by English firms, selling jewelry, outfittings, general furnishings, etc. These places are, as a rule, well lighted by acetylene or oil; but

1. The *Gas World.*

the highways and public thoroughfares are, as has been already stated, badly lighted. Probably, if some enterprising firm could furnish a general system of cheap lighting, a fairly good concession might be obtained; although the municipality are desirous of undertaking the matter, so that the ratepayers may reap the benefit of any profits that may be obtained. So far as I can see, however, it is very improbable that they will undertake the work on their own account. There is a good harbor, with a breakwater, offering berthing accommodation to 9 large seagoing vessels, so that there ought to be no difficulty with regard to transport in the event of the place being ultimately lighted by gas, as coals could be brought right up to the jetty and there discharged. There are plenty of coolies in the city, and the cost of labor is not heavy. The Harbor Board pay the men who discharge cargo 8 annas per day, which means from daylight till dark. There are 14 annas to a rupee, so that the cost is 16 cents per day in money. The wages paid by the municipality to the coolies who work for them, and a great number are employed, is only 4 annas per day. Women get 2½ annas per day.

What I have said about Madras applies also to other cities I have visited. Indeed, from Tuticorin, in the extreme south, to Cashmere in the far north, there is not a single town that is really well lighted. Bombay and Calcutta are the two best lighted cities in India, and in both there is room for improvement. Delhi is wretchedly lighted by oil. It may be that the natives do not want artificial light, and look upon those who use it as somewhat foolish. Soon after dark many of them roll themselves up in their blankets and go to sleep—the poorer of them in the pathways or against the walls of the buildings, whilst those who are better off curl themselves up in their shanties after dark and prepare to spend the night there. Others you will find in the cubicles where their wares are exposed for sale during the day, squatting down on the floor, squaring up their books for the day or diligently toiling to forward matters for the coming day, with their noses very near a miserable flicker of an oil lamp. A night or two ago, after dark, I went through the native quarter, and saw six tailors sitting inside a shop, squatting on the floor, all busily engaged sewing, with a flickering oil lamp, having an inch wick, on the floor in the midst of them. They must have splendid eyesight, for I was surprised that they could, under such conditions, see at all to sew. They were working hard—putting all their energies into it.

Jeypore.—At the time of writing I am in Jeypore, 199 miles S.S.W. of Dehi. It is one of the most beautiful and one of the most interesting cities and is the capital of one of the largest and most important Rajput States, which cover an area of 14,527 square miles. The city is laid out with much regularity, and is, in fact, the best planned city in India. It is surrounded by a crenelated wall, 25 feet high and 6 miles in length, with 7 entrance gates, with bastions and towers, at regular intervals. His Highness the Maharajah of Jeypore is the reigning sovereign, and his palace inclosure takes up one-seventh of the city.

I was rather surprised to find a gas works in this city, in an independent and protected State. The works was erected in 1878 by order of his Highness Maharajah Sawai Ram Singh, and cost originally 210,205 rupees. It has since been extended and now occupies a site of about 4 acres outside the southern wall of the city. Mr. John Dominy is the gas engineer. He is also waterworks engineer and engineer of the cotton presses, of which there are 3, two being in Jeypore and one at Mandoar, 76 miles distant. He is a hale and hearty man of 55, has been in India 22 years, and has been manager of the gas works for 11 years. Before he came to India he was a foreman at the Ebbw Vale works in Wales.

The gas is made from kerosene oil of the cheapest kind, imported from America. It was found that Russian oil would not suit the purpose. The gas is made in retorts 9 inches in diameter and 6 feet in length. There are 5 retorts in each bench and there are 3 benches. The oil arrives in tin cases, each case containing 65 pounds, or 8 American gallons. It is pumped into a tank a few feet higher than the retorts, which are heated to an orange or bright heat. From the tank the oil is discharged into the retorts in a very fine stream, which is regulated by a tap. The retorts are filled with small pieces of brick to help decomposition. From the oil a permanent gas is produced, which is, however, when made from pure oil, much too rich for lighting purposes in Jeypore, so that it has to be diluted. For this purpose two other retorts on each bench are used, which are filled with wood from the jungle. From this wood a quantity of gas is obtained with which the oil gas is diluted until a gas of 14 candles, when burning at 1½ cubic feet per hour, is obtained, this candle power being sufficient to meet the requirements of the locality.

The gas is conveyed from the retorts to the gasholders, of which there are two, each 45 feet in diameter, with a rise of 12 feet; and from these holders it passes into the mains. The street lighting is done by means of 729 lamps with glazed lanterns, each containing a batswing burner. The lamps are from 80 to 100 feet apart, and the entire city is thus fairly well lighted. The lighting is done entirely at the cost of the Maharajah, who also supplies the inhabitants with water free of charge, from hydrants in the streets. Those who have it laid on in the houses have to pay a water rate. His palace is lighted by oil gas, as are also the houses of the nobles. Outside this circle there are only two or three who use the gas for illuminating purposes, as it is too costly, the charge being 15 rupees per 1,000 cubic feet. Nearly all the shops and private houses use oil. The cost of making the gas is 7 rupees 8 annas per 1,000 cubic feet, and this includes a duty of 1 rupee on each case of oil imported. In fact, a duty has to be paid on everything imported into the State, and this duty generally amounts to about 4 per cent. of the value of the goods imported.

Inside and outside the gas works there are about 70 hands employed, and the wages paid are: Stokers, 50 cents per week; lamplighters, 41 cents per week; common laborers, from 4 to 5 cents per day. It will be seen that labor is very cheap. Human life is very cheap also. As an instance of this, a gentleman friend with whom I dined one night was, about two months ago, out driving on the high road and accidentally ran over and killed a native. An inquiry was held, and he had to pay as compensation to the widow 75 rupees. Shortly after this unfortunate occurrence his wife was out driving and she ran over and killed a native woman. Another inquiry was held, and she had to pay to the husband of the deceased 25 rupees.

The Economic Value of Testing.

In a paper read before the Northwestern Electrical Association, by Prof. George D. Shepardson, the author said: The aim is to show that it would be a capital investment to put more more money into buying accurate instruments and to have men competent to use them. It goes without saying that the manager of a manufacturing plant should know how much product he manufactures, how much it costs per unit, how many units he sells, how many are lost somewhere between the raw materials and the finished product, how many are lost or stolen between the factory and the customer.

Applying this to the operation of a central station for the manufacture and marketing of electrical energy, it is desirable and economical to keep systematic record of the amount of raw material used, namely, the amount of fuel, water, oil, carbons, lamps and other supplies; the output of the factory, namely, the kilowatt hours produced; the amount sold. The relation between amount of raw material and the station output furnishes a basis of comparison with the performance of other factories, and shows whether the cost of manufacture is reasonable.

The shrewd manufacturer desires to know not only whether he is conducting his operations about as economically as do others, but he wishes to know whether he is working as efficiently and as economically as possible. He is not satisfied to earn a 10 per cent. dividend because that may be the average performance of his neighbors, but he wants to know whether he can raise that 10 to 15 or 30 per cent. In order to accomplish this he must have detailed information about the actual working of his plant.

The portion of the income which every wise compauy sets aside for betterments can be expended most advantageously when the manager knows the condition and efficiency of every part of his system, so that he may be confident that $100 spent in one place will effect greater economy or other improvement than the same amount spent otherwise.

Information can be obtained only by testing. Every station does such testing to a less or greater extent. Where one man is superintendent, engineer, fireman, operator, lineman, trimmer, wireman, meter man, collector and general trouble man, the amount and quality of testing is necessarily limited. In larger stations where the responsibilities are differentiated, greater attention can be paid to details, and a larger amount of testing is practicable. The larger companies find it practicable and economical to maintain an elaborate testing department with one or more experts who devote their chief energies to systematic examination of all the parts of the business, seeing that everything is kept in the best possible condition. The syndicates which are operating central stations in different parts of the country find it pays well to maintain a competent and well equipped testing department. Many of the smaller independent companies are finding it profitable to engage the services of consulting engineers to make periodical examinations of their properties for the purpose of indicating leaks and economies. It is possible to err on the side of too much testing and superintendence, but actual cases of this sort are very rare indeed.

In most stations the testing can be done with reasonable satisfaction by the regular employees without seriously adding to their duties or responsibilities, and without imposing an alarming expenditure for equipment. When the necessary apparatus is installed ready for regular use, the ordinary employees can take the readings after a small amount of instruction and with proper care. The instruments should be checked at intervals not more than a year apart, by comparing them with other instruments known to be correct. This can be done by sending them to the maker or to a laboratory of good reputation. Most of the technical schools now have sets of standards which are correct within very close limits and with which other instruments may be compared at small cost.

A considerable part of the testing can be carried on without any instruments other than a good eye directed with judgment and a knowledge of what is correct modern practice. Too much importance cannot be given to frequent and thorough inspection of the entire system by the superintendent or by some other person whose eye will notice apparent defects. An example may be noted where a 220-volt plant was so heavily overloaded that the ownars were about to install larger machines. A young man who had not yet completed his technical course at the State University was sent to look over the situation; by careful inspection he was able to locate poor insulation. After overhauling the lines he increased the number of lights installed by about one-third, and even then the load was one-fifth less than before his arrival. In the same plant, by the careful use of a portable voltmeter, he was able to locate a number of bad splices and to show where the circuits should be strengthened with greatest profit. It is not necessary to send away for an expert in order to locate poor work where the lineman has made a "temporary" job in an emergency with the temperature below zero and a Dakota zephyr gently playing about his ears; nor is it difficult to detect lines crossed and lying on the cross arms, resting against trees and iron roofs and similar violations of insurance rules.

Every engineer recognizes the prime importance of feeling his bearings to detect any signs of undue heating. The electrician can also detect poor electrical bearings in similar manner. Dynamo operators make a practice of feeling various parts of their machines to see that the brushes, holders, studs, switches and other contacts make good connection and keep cool. The same vigilance should extend to the switchboard. Poor service due to excessive drop in the lines may frequently be traced to loose and poor contacts in switches and fuse blocks. Unless the fuses have hard terminals, they expand and squeeze out from under the screws and then become loose. The insurance rules call attention to this point, but fail to note that the screws in the switches as well as on fuse blocks work loose and often introduce so much resistance as to lower the voltage quite appreciably. In such cases local heating always occurs unless the circuit becomes opened entirely.

Flexible cables often heat excessively when soldered into terminal lugs, due to the fact that the individual wires were not properly cleaned and tinned before soldering, so that only the outside layer of wires are connected and these have to carry the whole current.

An occasional inspection of fittings and conductors at time of full load will often locate unsuspected sources of trouble.

In order to illustrate the actual value of testing, a few instances will be quoted from a collection of data gathered from central stations and isolated plants in various parts of the country, showing conditions that actually exist where there is little or no systematic testing.

One of the first sources of loss may be found in the boiler room, where the fuel may have been exposed to the weather and is in poor condition for use. The appearance of the smoke will indicate something of the quality of the firing. In one case the correction of leaky boiler settings and insufficient stack, which had affected complete combustion, effected a saving of 20 per cent. of the fuel bill.

In another case, proper cleaning of the feed water heater and of the boiler cut down the fuel consumption by 30 per cent. Grates not suited to the fuel, poorly proportioned grate area, poor boiler setting, poor draught, poor water, cold feed water and dirty flues are as a rule discoverable by the skilled eye without many instruments. Periodical cleaning and inspection of the boiler will increase efficiency and diminish accidents. Steam gauges are not uncommonly inaccurate. Track scales for weighing fuel and ashes, thermometers for checking temperature of feed water are of great importance, and the meters or tanks for measuring the amount of water evaporated will generally pay for themselves. Insufficient covering of steam pipes may be detected by the eye and hand. Excessive drop in steam pressure between boiler and cylinder will appear from the indicator card or from the difference between pressure gauges at boiler and at engine. A calorimeter for determining quality of steam is neither expensive nor very complicated in operation. The intelligent use of the indicator will detect improper setting or worn condition of valves. In one instance poor valve setting increased the fuel consumption 40 per cent.; the engineer had an indicator, but did not know how to interpret the cards nor how to apply the remedy.

Tests of several stations operated by one of the largest corporations in the West showed that the insufficient heaters in two stations were costing more than $2,400 and $2,500 respectively each year of operation, and the saving effected by changes paid a good interest on the investment and went far toward the maintenance of the testing department.

Improper condition of the engine governor or uneven belt will appear in the unsteadiness of the lights. Dirty condition of the dynamo and improper setting of brushes, which are liable to induce trouble, will be detected by visual inspection. Poor regulation of voltage, one of the most frequent sources of trouble and loss, may be caused by speed variation, by improper compounding of generator, by inattention to the regulator and voltmeter, by overloading or poor design and construction of the circuits.

On the switchboard the most common sources of loss are the integrating wattmeters and the voltmeters. In a suprisingly large number of stations the switchboard wattmeters are like snakes in Ireland; there are none. Correct integrating wattmeters are of the greatest importance for registering the output of the factory. By comparing the fuel consumption with the kilowatt hour output the superintendent has at once a means of determining the efficiency of his station operation. It gives him records for comparing his work from week to week and thus for detecting serious changes in the efficiency of the station as a whole; it gives him the data for comparing the performance of his station with that of other stations and indicates how much improvement he may reasonably expect from his equipment; it gives him a means of noting any excessive discrepancy between station output and the energy registered by the consumers' meters; it gives him a means of comparing lamp breakage with service rendered, and so gives a check on poor lamps and on poor regulation; it gives him a record of the changes in daily, monthly and yearly load.

An interesting illustration of the value of station wattmeters was that quoted by Mr. Wirt before this Association last January; during the year ending June 30, 1900, the station wattmeter showed 729,923 kilowatt hours delivered to the commercial circuits, while the consumers' meters read in the aggregate only 309,001 kilowatt hours, or 42 per cent. of the station output. This must have opened the eyes of the superintendent, for the next year the station wattmeter showed 671,006 kilowatt hours, while the consumers' meters registered 393,223 kilowatt hours, or 58½ per cent.; thus the paying load was increased while the station output was diminished. Another station reported a line efficiency of 75 to 90 per cent., showing a still better performance.

Care needs to be taken that the station wattmeters are properly installed and are properly calibrated. Station wattmeters are sometimes affected by the magnetic fields due to bus bars or other sources; sometimes the jar makes them run fast. Direct current instruments may be checked by ammeter and voltmeter without difficulty. With alternating currents, it is necessary to get a non-inductive load, such as a bank of incandescent lamps, or else to have a current wattmeter for checking purposes.

When the station is not supplied with wattmeters, the lack may be partially offsett by readings taken every half hour from the switchboard ammeters and voltmeters. From these the output of a direct current station may computed from hour to hour and for the whole run. It is desirable to supplement the daily or hourly wattmeter readings by the voltmeter and ammeter readings. In an alternating current station the product of volts and amperes will generally be greater than the true watts delivered. In any station it is desirable to preserve a record of voltage, either by readings every half hour, or, better yet, by a continuously recording voltmeter.

The consumers' wattmeters naturally come in for consideration at this point. It is now generally recognized that all customers should be on meters. Flat-rate customers almost invariably have the best of the company. The rates are generally lower than meter rates; customers have little incentive to economical use of current. One notable case maintained for 7 years a flat rate of $1 per month for each residence, irrespective of number of lights. That was a municipal plant. In one case the load was reduced 50 per cent. by compelling the use of meters, thus allowing the taking on of additional load without increase of equipment other than meters. Experience shows that the reduction of load by changing to meters does not involve a corresponding decrease in revenue.

Wattmeters need to be purchased with some discretion, and need to be tested for accuracy at least once a year. They should in every case be tested before being placed in service and when changed from one location to another.

One superintendent reports that when he took charge several years ago it was quite common to find monthly meter charges of only a few cents, even in winter time; since cleaning and correcting meters, and establishing a minimum monthly charge, the improved financial showing has earned his salary several times over.

It seems not uncommon to find meters running from 10 to 40 per cent. slow on full load, and requiring considerable load before starting. Most stations would increase their income by using meters with greater accuracy at small load. In many cases this can be accomplished by using smaller meters. By using induction meters on alternating current circuits, the light load registration has been greatly improved. It is desirable to have all meters of the same kind, especially in smaller stations, which cannot afford to keep a meter specialist. Cases are reported where customers buy their own meters, and where every different kind of meter on the market adds to the trials of the superintendent; it is needless to say that choice of meter, and preferably the ownership of same, should rest with the company.

Meters should be cleaned and tested at least once a year. This should be done during the summer, both because the station men have more time, and because the lighting bills are so small that consumers do not notice the change. No sane meter man would choose December as a proper time to clean a meter that was found to be 40 per cent. slow.

Good voltmeters are even more essential than station wattmeters. The ammeters may be only current indicators and their accuracy is of only secondary importance. But a good voltmeter, properly used, is vital to the satisfactory operation of the plant, and it should be accurate within at most 1 per cent. The voltmeter is the gauge by which the pressure is regulated, and proper regulation is the measure of satisfactory service. The voltmeter should not only be accurate in itself, but it should indicate the voltage at the main center of distribution, or at the point of important consumption. This may be accomplished by bringing pressure wires back to the station, or by using some sort of compensating device which will correct for drop in the lines. Good station instruments should be supplemented by accurate portable instruments, by which to test conditions prevailing on the circuits. Good portable instruments are as essential as those in the station if close regulation is to be attained.

The importance of close and correct regulation of voltage is not sufficiently appreciated. Lamp makers have insisted for years that the life of a lamp is greatly shortened by excessive pressure; that an increase of 3 per cent. above normal voltage cuts off the life of an incandescent lamp by one-third, and that an increase of 6 per cent. in voltage takes away about seven-tenths of the life of the lamps. High pressure not only shortens the life of the lamps, but it educates consumers to expect 30 to 50-candle power from a 16-candle power lamp, so that much dissatisfaction follows the correction of the voltage. Moreover, high pressure increases consumers' bills out of all proportion, an increase of 10 per cent. in the pressure causing an increase of more than 20 per cent. in the watts taken by the lamps, while the cost of lamp renewals is appalling. Low pressure is almost as bad as high pressure, for while the lamps last much longer they give so poor light that the people resort to oil lamps, candles and anathemas.

Excessive high or low pressure is often experienced in various parts of the system when the station operator believes that the pressure is normal. The station voltmeters frequently read low, so that the pressure is actually higher than indicated. Reports at hand show station voltmeters reading from 1 to 20 per cent. low, only a very few reading too high. The general tendency is for ammeters and voltmeters to read low as the age. Comparatively few stations seem to be provided with portable voltmeters. These are essential for checking line losses and distribution of load. No matter how skillfully the circuits may have been designed, the load is sure to change from the conditions assumed, some circuits will be overloaded while others are light. The result is the drop varies in different parts of town and at different hours in the day. Poor service means dissatisfied customers and slow increase of business. The use of a portable voltmeter will show what lines have too high voltage, what ones are too low; by a systematic study of the situation the causes may be located. A few cases may be cited to illustrate. One company was renewing about 1,000 lamps per month, about one-tenth of the entire number installed, on account of poor regulation caused by improper balancing of load on the different feeders, and by not tying secondaries in the business district. Another case of poor lights was located by a portable voltmeter showing 128 volts where 110 was intended, the trouble being traced to some intelligent wireman who connected service wires to the pressure wires running back to the station. Poor service on a secondary four blocks long, with a transformer at each end, was found to be due to the blowing of the primary fuses of one transformer. Other cases of poor service were traced to poor splices not soldered, but carefully taped, to small mains, to improper interior wiring. In two adjacent stores connected to the same transformer the full load voltages were found to be 93 and 102 respectively. In a 3-phase plant with power house 5 miles from town a voltage variation of 15 per cent. in different parts of the town on moderate load was corrected by transferring part of the load to other legs of the circuit, by installing heavier transformers and heavy secondary circuits in the crowded district and by moving the smaller transformers to the thinly lighted districts. When my informant took charge of this plant there was no portable voltmeter in the county, and the only station voltmeter was 5 miles from the load. The purchase and intelligent use of a portable voltmeter quickly indicated the causes of dissatisfaction and the remedies became plain.

A supply man reports a case where the incandescent lamps were not giving satisfactory life; queries about the regulation were always answered that the regulation was first-class and that the lamps gave good light. A personal visit developed that the engineer had no voltmeter at all and did not wish any, for he could tell by his eye when the lamps were at proper voltage. As a corroboration of his judgment, the supply man tried his voltmeter and found that the 104-volt lamps were operating at 116 volts.

One superintendent reports his success in determining the distribution of his load by putting a maximum demand meter into the primary circuit of transformers or into branches of secondaries. By moving this instrument from place to place, cutting it in at the fuses or wherever convenient, he is able to locate the causes of dim lights.

Since many conflicting statements are made by lamp agents, each of whom has positively the best lamp on the market, and, in fact, the only one that an up-to-date station can afford to use, the only wise thing to do is to make tests, or to secure the results of impartial tests made by others. Many central station men are suspicious of photometers, feeling that only experts can use them correctly. As a matter of fact, it is far simpler than an engine indicator, and with a good voltmeter and careful operation will easily give results reliable within 2 per cent. It is also an open secret that lamp makers are apt to furnish a more uniform selection of lamps at the same rate to stations known to have photometers for testing, and that they dispose of irregular stock to stations which do not know whether they get what they want or not. (This is not saying anything against the lamp men, for if they do not dispose of irregular products profitably, the cost of good lamps must increase accordingly.) As an example, a recent test of 35 lamps furnished to a station without a photometer showed only 6 out of 35 which came between 13½ and 17-candle power, the others ranging all the way from 9 to 20-candle power. Remarkable tales are told of the performance of bargain lamps sold by drug and department stores where the stations do not furnish renewals free or at a cost below competition.

The importance of close regulation of voltage is emphasized at almost every electrical convention, yet poor regulation is one of the most common faults in station practice. A recording voltmeter on an important feeder from one of the largest stations in the Northwest, and operated by one of the large syndicates, shows a pressure fluctuating from 112 to 140 volts on a secondary supposed to give 110 volts. The effect on the lamps and on the cost of lamp renewals may be imagined. Photometric tests of 45 lamps from one building served by this feeder showed a range from 4.1 to 15.7 candle power, with efficiences running from 3.27 to 7.7 watts per candle, the lamps having been bought for 16-candle power at 3.1 and 3.5 watts per candle.

In securing equipment for methodical testing, it is well to keep in mind that satisfactory service is more important than efficiency, for "the better the service, the more customers; and the more customers, the cheaper the cost of production." The most important testing instrument, therefore, is a portable voltmeter known to be accurate within 1 per cent. With this the station voltmeter can be tested and then be retained, corrected or replaced. The engine indicator is of next importance, for it is most likely to locate causes of poor economy. With this should come a tachometer or a speed indicator. Then should come scales for weighing fuel, switchboard wattmeters for each class of circuits. Then a portable ammeter accurate within about 1 per cent.; for measuring direct currents, this may be a "round pattern" instrument provided with a number of shunts from one ampere up so as to obtain a variety of ranges; for alternating currents an ammeter about 15 amperes capacity and one about 50 or 100 amperes capacity will generally

answer; then add water meters and thermometers and calorimeter and pump register; then add photometer, recording voltmeter; then for an alternating current station add two or more wattmeters, one for testing watt consumption of incandescent lamps, and one for testing meters, motors and arc lamps. There is a difference about the relative importance of the instruments, and the order in which they should be secured, but the above order will be about right.

The question of the extent to which a station of moderate size should afford to maintain regular testing is an open one. A consulting engineer of excellent reputation, who has been helping better the performance of central stations, says: "My procedure is to get the owner to mail me daily an hourly record of coal consumption, feed water consumption and kilowatt hour output as measured by the integrating wattmeter; also kind of coal, temperature of water, steam pressure, and any readings of ammeters, voltmeters, indicating wattmeters, steam indicator diagrams, etc., which would affect the economy of operation; also a daily record of load factor as measured by wattmeter; that is, the ratio of average load to maximum load for one hour. By preparing an hourly record, operators get down to business and educate themselves on the subject of pounds of coal per kilowatt hour. I will not take charge of a station using old style or 133-cycle transformers or any decidedly inefficient apparatus, nor unless there is provided a Weston voltmeter in reserve, an indicating wattmeter, thermometers, a cold water meter, coal scales, an engine indicator, a counter on pump, and keep these instruments calibrated. The monthly financial statements must also be furnished. Some of the results now obtained are excellent and the improvements most satisfactory. Systematic cleaning, inspections, tests and hourly records are to my mind necessary to pay maximum dividends."

Electric Conductivity of Filaments of Nernst Lamps.

According to the *Electrical Review* (London) it is known that pure liquid substances, as a rule, possess rather low elcctrolytical conductivities; in most cases of electrolytical conduction solutions are therefore present. This is equally true of the solid state, as the metallic oxides of which the filaments of Nernst lamps are made up are always solid solutions of one or more oxides in another; they ought to undergo a most rapid reduction, were the mechanism of their conduction wholly analogous to that exhibited by liquid electrolytes. Now, these filaments are known to stand the passage of very intense continuous currents for hundreds of hours. If, therefore, their conductivity be really an electrolytic one, there should exist some simultaneous antagonistic process compensating the effect of electrolysis, in the sense of Nernst's "residual currents" (Restströme").

A paper recently published by E. Bose in the "Annalen der Physik" deals with this interesting questton, the result of the experiments recorded being that the filaments of Nernst lamps really show such an electrolytical conductivity, complicated by a secondary compensating process.

Bose presumes that, in the case of those metallic oxides, the velocity of migration of the cation is much lower than the one corresponding to the anion, so as to impart a preponderant role in the conduction process to the latter, the oxygenion. The oxygen evolved at the anode rediffuses within the filament towards the cathode, where it oxidizes anew the metal deposited in the pure state, this process being accelerated by the atmospheric oxygen surrounding the filament and filling its pores. Now, this "residual current," forming, together with the electrolytical migration of the ions, a closed cycle, could be either external or internal, according as it takes place in the ambient air and the air filling the pores (thus giving electrolysis with excellent depolarization), or within the oxide itself, as at high temperatures oxygen is likely to be readily absorbed by the oxide. It even seems as though both peenomena occurred at the same time.

Evacuating the tube surrounding the filament, Bose states that the conductivity of the latter gradually increases as the exhaustion augments, its color passing at the same time from brilliant white to a dark red. Investigating closely this phenomenon, the author observes that filaments extinguished in a vacuum will show a dark grey color as the air is allowed to enter again, this coloration being most probably due to a thin metallic stratum. This stratum readily disappears if, instead of allowing the filament to go out, the air is restored immediately.

These phenomena clearly show that a more or less rapid reduction of the filament is taking place, the liberated metal being burnt by incandescence in the atmospheric air.

This equally results from the fact that, while the current is kept on, the vacuum cannot be increased so far as to cause the appearance of green fluoresence on the walls of the tube, whereas this result is easily arrived at on opening the circuit. This is due to the oxygen evolved by electrolysis of the filament as the lamp is worked.

On the basis of these results, Bose thus explains the alterations of the conductivity in a vacuum: The metal liberated at the cathode, not being wholly burnt, forms rather thin dendrites advancing, within the filament, towards the anode. The more perfect the vacuum, the less complete is the oxidation, and the further the metal will advance towards the opposite electrode. The filament burning in a vacuum thus forms a system possessing, to a greater or less extent, besides electrolytical, a metallic conductance, whereas in the immediate neighborhood of the anode there exists an often very short section with purely electrolytical conductance.

These facts account for two points known for some time to makers of Nernst lamps: First, the life of the filaments is reduced to a considerable extent by frequent changes of polarity, on account of the partial reduction of these oxides, the metal liberated giving rise to internal stress, owing to its change of volume. Secondly, the filament will burn with less brilliancy in the portions where metal is reduced on account of the increased conductivity. Now, it is known that the efficiency of a lamp increases very rapidly with rise of temperature. The darker parts, accordingly, will lower the efficiency, and the lamps run by alternate current will be more economical than direct current lamps, the latter undergoing a partial reduction to metal. Moreover, this reduction will deprive the filament of part of its selective emissive power, to which the high efficiency of Nernst lamps is said to be due.

During his experiments with vacuum lamps, the author made the interesting observation that a light of a shining blue color will appear in the neighborhood of the filament, imitating in a most striking manner the color of the sky. In accordance with Lord Rayleigh's views, Bose explains this phenomenon, presuming that metallic particles are emitted by the oxide, these particles being of the order of magnitude of light waves and exhibiting a selective reflective power for small wave lengths.

The author finally records some experiments on gaseous currents passing between a filament and a metallic electrode, or between two metallic electrodes placed in a vacuum in the immediate neighborhood of the filament.

The Industrial Situation in Germany.

Engineering notes that in an interesting report from the French Consul-General at Stuttgart, it is stated that, in manufacturing industries, matters are still in a very bad state in Germany. It was hoped that matters would have recovered themselves a good deal within the the past twelve months; but many careful observers think that the worst part of the crisis has still to come. Germany has now an absolute need of finding foreign outlets for a large proportion of her products.

During the past ten years factories have multiplied and extended, the banks taking a leading part in providing the necessary capital, so that as matters stand the normal output of these works is far in excess of the domestic demand; and at the same time the population has outgrown the indigenous agricultural resources, and food-stuffs have therefore to be imported on a very large scale. For some years exceptional circumstances have favored the growth of German industries; but this good time is now past. Bankers are no longer ready to provide factories with capital, and are even calling in that already advanced, and the confidence of the public in industrial securities has evaporated. England, the Consul-General continues, having finished her war, is showing renewed commercial activity, whilst the pressure of the United States in the competition for neutral markets can no longer be neglected. Nevertheless, the fact remains that it is the immense demand for iron in the United States which has so far enabled the Germans to confine the industrial crisis within certain limits. It has, it seems, been the American orders which have enabled the German iron industry to be maintained. The action of the "cartels" is of importance, and the question is being raised anew as to whether the advantages gained by these syndicates really compensate for the inconveniences inseparable therefrom. The States have bought iron in Germany because it was cheaper than elsewhere; but this iron has often been sold by the "cartels" at a price yielding absolutely no profit. It has been made simply to keep the works together and the workmen employed. The syndicate, however, recoups itself by the price it exacts in the domestic market, where it is protected against exterior competitors. The German purchasers of the raw material who have to sell their products abroad are therefore handicapped in competing against foreign firms using, perhaps, exactly

the same raw material furnished by the same makers, but at a cheaper rate.

The supporters of the "cartel," however, contend that there is, nevertheless, a balance of advantages, as otherwise certain of their works would have to be shut down. Fears are expressed that the American demand must soon diminish, and some new outlet must be found for the iron made in excess of the domestic demand. The output of pig con tinues to increase enormously. This increase of production has not benefited the home manufacturing industries, since the consumption of iron per head has steadily diminished since 1900, being last year 66.6 kilogrammes, as against 132 kilogrammes in the preceding year. Work in the machine shop has, it is stated, steadily diminished, part of the hands being dismissed and the rest put on short time. This distressful condition of the machine shops has had a considerable influence in insuring the prolongation of the pig iron "cartel," the alternative to which was an internecine fight in the home market between the different iron smelters. The mines are stated to be in a better condition than the metallurgical industries, the recent strikes in France and America increasing the demand for German coal and coke. Attempts are being made in this industry to institute a sliding scale arrangement. The heaviest losses have been in the electrical trades, the Allgemeine Electricitats Gesellschaft being almost alone in making a good showing. This state of affairs has led to a project for forming an electricity "cartel" embracing the principal German firms. The Consul-General adds that even the cement industry, which has of late years been so prosperous, has recently suffered severely. Owing to a mutual agreement as to prices, some firms have distributed small dividends; but in most cases the year's trading has resulted in a deficit, and stocks still continue to accumulate. It is, therefore, proposed to form another "cartel" for this industry. In short, all the great German industries seem to be inclined to organize on the trust basis, and, like the pig iron "cartel," will sell at near the cost of production in foreign markets, whilst attempting to recoup themselves by high prices at home.

A "Business" College President.

Electricity, in editorial comment on the named topic, has this to say: The New York *Commercial* says there were many "good things" said at the inauguration of President Humphreys of Stevens Institute and the dinner at Sherry's following it—not "bon mots" of the ordinary after dinner sort, but solid sentiments that give persons who think something to think about.

"Some engineers fail to secure success," said the new President, "because they carry too large a proportion of science; some because they have not enough; and others because they fail to recognize that commercial efficiency must outweigh theoretical efficiency." It is quite probable that much the larger proportion of such failures is due to the last named cause—the lack of "commercial efficiency." In these times more than ever before, the "business end" of every great engineering proposition must be understood quite as well as, if not better, than the purely scientific or technical side of it. Capitalists looking for an engineer to plan and construct a tunnel must find one who cannot only do the work and do it right, but also do it cheap and make the thing pay. It is not the tunnel they are bent on having, but the profits from operating the tunnel.

"The training of the engineer," concluded President Humphreys, "must be a harmonious blend of science, practice and commercial judgment. And here, though we can yet do much to increase the percentage of graduates of this quality, we are, so far, ahead of theworld."

Albeit "comparisons are odious," it is unquestionably true that the new head of Stevens Institute takes to the institution a larger measure of this "commercial judgment" than any other technical school or college in the country can boast of in its President. It is the first instance on record, we believe, where an institution of learning has stepped out of the beaten path and plunged straight into the heart of businessdom for a President. "A man who makes a big fortune," said Andrew Carnegie at the inauguration, as he faced the new President, "can do a great deal of good with it, and can prove to be a big and useful person in the world. The man who gives up his opportunity to amass wealth and devotes his career to the cause of education is a much bigger and more useful man. That's what Mr. Humphreys has done. He has chosen the better part."

It is surely an epoch in our educational and commercial history when the successful executive head of more than half a hundred business enterprises quits wealth making and goes to teaching the young men of the country how to "harmoniously blend science, practice and commercial judgment."

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Syracuse (N. Y.) Gas Company the following officers were elected: Directors, Michael Whelan, George A. Wood, F. J. Baker, Jerome L. Cheney and William E. Tanner; President, George A. Wood; Vice-President, Michael Whalen; Secretary, Jerome L. Cheney; Treasurer and General Manager, John J. Cummins. The reports showed that the Company had enjoyed a most prosperous year, and General Manager Cummins, to whose energy and cleverness much of the recent success of the Company is due, stoutly claims that 1903 will show far better results than those reported for 1902.

Messrs. Martin V. Wood, Chas. F. Giltens, Henry T. Duke and H. J. Venner have filed a certificate incorporating the Nassau County Gas Company, which proposes to furnish gas and electricity in the towns of Hempstead, North Hempstead and Oyster Bay. The concern is capitalized in $100,000.

The following is the full text of the measure recently introduced in the General Assembly of Rhode Island, which has for its object the regulating of the price of illuminating gas in the city of Providence:

Section 1. No person or corporation in the city of Providence shall ask, demand or receive for illuminating gas a sum to exceed 65 cents per 1,000 cubic feet, and such gas shall have an illuminating power of not less than 24 sperm candles of six to the pound and burning at the rate af 120 grains of spermaceti per hour, tested at a distance of not less than a mile from the place of manufacture, by a burner consuming 5 cubic feet of gas per hour, and shall also comply with the standard of purity now or hereafter established by law. And no corporation or person in said city shall ask, demand or receive for gas more than 65 cents per 1,000 feet.

Sec. 2. The Superintendent of Public Buildings in the said city of Providence is hereby authorized and empowered, and it shall be his duty, to investigate and supervise the methods, appliance and plant of of any corporation or person engaged in supplying or distributing illuminating gas in said city, and to inspect, examine and ascertain and prove the accuracy of any and all gas meters used or intended to be used, for measuring or ascertaining the quantity, or the quality of illuminating gas furnished by any corporation or person, and he shall have power, in any investigation instituted by him, to issue subpœnas, to summon witnesses, to compel the production of any books or papers, to administer oaths to the witnesses so subpœnaed, and to do each and everything necessary to the full and complete performance of this act, under and in pursuance of any and all ordinances which may be prescribed and enacted by the City Council of said city.

Sec. 3. The City Council of said city of Providence is hereby authorized and empowered, and it shall be their duty, to make and enact any and all ordinances that may be required or recommended by said Superintendent of Public Buildings.

Sec. 4. The Board of Tax Assessors is hereby authorized and empowered to make provision, either by the issue of bonds or by the insertion of the amount required in the annual tax levy of such city, as shall be determined by them for the payment of all requisitions that may be made upon the said Board by said Superintendent of Public Buildings for the necessary expenses in carrying out the provisions of this act.

Sec. 5. Any corporation or person violating the provisions of this act or the ordinances enacted by said Board shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than $200 or by imprisonment in the county jail for a period not exceeding 30 days, or by both such fine and imprisonment.

Sec. 6. This act shall take effect immediately.

The sale of the plants and properties of the Rome (Ga.) Gas Company, which was te have been made on the afternoon of the 4th inst., was postponed indefinitely. The court referred the matter of disposition back to Judge Newman. It is thought the bondholders have settled their differences, and that they will buy the shares in the concern and thereafter operate the property on joint account.

Mr. Bascom Parker, of Niles, Mich., is the latest applicant for the right to operate a gas works in Holland, Mich. He agrees to supply gas at an all round net rate of 95 cents per 1,000 cubic feet.

Mr. Pierre Plantinga writes us that the Gas Machinery Company, of Cleveland, O., has secured a contract for the construction of a coal

gas plant at Joliet, Ills., rated to a capacity of 750,000 cubic feet per diem. The contract calls for duplex purifiers, operated by means of duplex reversing and bye-pass valves, exhausters, and all general machinery required around the plant, including pumps, boilers, etc. The benches are to be furnished by the Parker-Russell Mining and Manufacturing Company.

A CORRESPONDENT forwards the following: "The shareholders in the Key City Gas Company, of Dubuque, Ia., at the recent annual meeting had the satisfaction of hearing that, from the reports of the officers, the business for the past year eclipsed the highly creditable returns made for years back in the matter of gas sales. In the lighting department the gain was especially heavy, the sales on lighting account during Christmas week showing a gain of more than 30 per cent. over the corresponding period of 1901. There was also a very large gain in consumers of gas for fuel. The number of ranges placed exceeding by 100 the large sales of 1901. The Company's physical standing was reported in excellent condition, and, barring the high price of gas coal, the shareholders found every prospect pleasing. The officers elected were: Directors, Jno. V. Rider, Thos. Connolly, Jacob Rich, D. D. Myers, George McLean, Wm. L. Bradley and B. W. Lacy; President, W. L. Bradley, Vice-President, B. W. Lacy; Secretary, George McLean; Treasurer, J. K. Deming. The Key City Company has for several years pursued a policy of liberality and progressiveness in dealing with the public which is receiving a well merited reward. In the matter of both rates and service it puts the gas consuming public in a fortunate position. The Company installs stoves and other gas consuming appliances below cost to itself. Service pipes and connections to stoves are furnished without charge to the consumer."

CAPTAIN JOHN H. KAUKE, President of the Wooster (O.) Gas Light Company, is the oldest business man in the history of that bustling place. He was born in Wooster, December 16, 1817, and the current year finds him daily attending to the things that are all the time cropping out in the many enterprises in which he is interested. He was elected President of the Wooster Company in 1888.

THE Mainland Gas, Heat and Power Company to supply gas to the residents of Pleasantville, N. J., has applied to the Council for an ordinance. The Company's officers are: President, Dr. R. M. Sooy; Secretary, David Price; Treasurer, Chas. Burkhead; Solicitor, Joseph C. Farr.

AT the annual meeting of the Charleston (S. C.) Consolidated Railway, Gas and Electric Company, Mr. Francis K. Carey will retire from the Presidency thereof. His successor will be Mr. Philip Gadsden, who has been Vice-President of the concern for about 3 years.

MR. J. D. SHATTUCK, General Manager of the Suburban Gas Company, of Philadelphia and Chester, Pa., has announced that, after April 1st, the district between Chester and Ridley Park will be combined, which combination will include the boroughs of Eddystone, Ridley Park, Prospect Park, Leiperville, Fairview and Crum Lynne. The above country district is under the jurisdiction of the Darby office. While the main office will be in Chester, the branch office in Ridley Park will be maintained. The main office of the district including Swarthmore, Rutledge and Morton will be at Media, and the Darby office will be headquarters for the district that includes Darby, Sharon Hill, Glenolden and Norwood.

CERTAIN capitalists have made offers for a control or all of the stock in the Newton and Watertown (Mass.) Gas and Electric Light Company, but it is not likely that the property will change hands, for it is controlled by a hard headed, common sense set of men, who are quite up to getting out of their various enterprises about all that there is in them.

AT the annual meeting of the Northwestern (O.) Natural Gas Company the officers elected were: President, Daniel O'Day; First Vice-President, C. N. Payne; Second Vice-President, E. Strong; Gen. Manager, M. B. Daly; Asst. Gen. Manager, Jno. Tonkin; Secretary and Treasurer, George W. Colton; Asst. Sec. and Treas., R. J. Burkhalter; Comptroller, John Bushnell; Superintendent, J. W. McMahon.

SHARES in the Louisville (Ky.) Gas Company have advanced to 120, the rise being based on the belief that some sort of a deal is on between the Louisville Company and the Kentucky Heating Company. We don't believe it.

ACCORDING to the New Haven (Conn.) *Leader* of the 6th inst., Chas. H. Nettleton, President of the New Haven Gas Company, appeared on the 5th inst. before the Committee on Incorporations of the Connecticut Legislature, and petitioned for an increase in the Company's stock to $5,000,000 from $3,000,000. In his argument Mr. Nettleton said that the growth of the city was so great as to necessitate large main extensions and plant increase. In fact, the Company last year had put down 17 miles of main lines and 15 miles of service pipe, and that this year at least as much more work in like respect would have to be done. Mr. F. M. Travis, Treasurer of the Company, spoke in like manner. The point was also brought out that the stock was not to be issued in bulk, but only such sums as the requirements of the corporation called for. There was no opposition to the petition.

WE have it on good authority that Mr. C. J. R. Humphreys will not resign from the active management of the Lawrence (Mass.) Gas Company, the business operations of which he has conducted with consnmmate skill for well on to a score of years.

THE reorganization of the Harrisburg (Pa.) Gas Company has been completed by the United Gas Improvement Company, which corporation is now sole owner of the Harrisburg concern. The understanding is that on or before May 1st the selling rate at Harrisburg will be reduced to $1.25 per 1,000.

AT the annual meeting of the shareholders in the Consolidated Gas and Electric Company, of Batavia, N.Y., the following officers were elected: Directors, D. Y. Lewis, H. B. Gayley, H. Lauterbach, R. C. Garhart and C. O. Lawton; President, D. Y. Lewis; Vice-President, H. Lauterbach; Secretary and Treasurer, R. C. Garhart.

A CORRESPONDENT incloses the following, from Ashland, Ore., under date of the 4th inst.: "Excellent samples of coal have been brought into Grant's Pass by miners from the Upper Applegate district. The immediate location of the discovery is on Dutcher creek, which is a tributary of Applegate river. The samples of coal brought in are of very good grade. The discoverers report that the vein uncovered has a width of 22 feet, and that the whole face of the ledge shows the same quality of the black diamond. The discovery has created considerable comment among mining men there. Coal has been discovered, and is to be found in a number of southern Oregon districts, but the trouble in each instance has been in the veins being too narrow to be profitably worked; or if of good width, the main ledge would be seamed with narrow stringers of slate, spoiling the whole. But in the discovery just made in the Applegate district, the miners claim that the whole ledge is solid."

THE authorities of Aberdeen, So. Dak., have granted a 25-year franchise to the owners of the Aberdeen Gas Company. They will this season construct new gas and electric lighting plants.

A CORRESPONDENT sends the following from Lowell, Mass., under date of the 7th inst: "The Lowell Gas Light Company has opened an attractive show room, next door to the Union bank, on Merrimack street, where it is exhibiting all the modern gas ranges and heaters, with special appliances. The gas office is still at the old stand in Shattuck street, and the new enterprise is for the more convenient showing of gas stoves. The rooms are handsomely fitted up, and there is every facility for demonstrating the advantages of gas for heating and cooking purposes. Miss Genevieve Severy, of the Boston Cooking School, with an assistant, will have charge of the demonstrations, and will be ready at all times to explain the proper use of the ranges. She will also go to private houses, when called upon, to assist the ladies who are unfamiliar with the use of the gas stoves, in mastering the details. In addition to the above, it is expected that Miss Severy will give, once or twice a week, free demonstrations to invited guests, showing how to use the ranges to the best advantage, in preparing a dinner, supper or breakfast. In this way, it is expected that the public will benefit by gaining a general knowledge of the possibilities of gas in cooking, which are not fully understood."

MR. G. H. CHAMBERLAIN, formerly head clerk to the Grand Rapids (Mich.) Gas Company, has been moved up to the management of the appliance department of the Company, vice Mr. Clarence Mackey, resigned.

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MONDAY, FEBRUARY 16, 1903

The Market for Gas Securities.

There is no change to report in the condition of the local gas share market. Trading in Consolidated was very light, and the net result of the transactions for the week leaves the price where it was last week. The last sale to-day (Friday) was made at 217. The demand for city gas bonds is still a feature.

Brooklyn Union is dull and inactive, and last week's figures prevail as the nominal quotations. Peoples, of Chicago, maintains its strength. The closing sale to-day was reported at 107. The feature of the out-of-town market was the rise in Louisville (Ky.) gas, which moved up sharply to 130 bid, on something seemingly more substantial than rumors, that the New York syndicate represented by W. T. Sheehan had arranged for the purchase of all the stock of the Louisville Gas Company held outside of city account, and all of the stock of the Louisville Electric Light Company, which property is owned by the Gas Company. It is said the syndicate's offer was $130 per share. Bay State is $\frac{5}{8}$ to $\frac{9}{16}$.

The "reorganization" plans for doing over the control of the financial part of the companies that supply gas to "Boston and adjoining places" are distinctly inimical to that which is left of the Bay State Company, of Delaware. Cincinnati Gas and Electric is at the par line.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

FEBRUARY 16.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	216¾	217¼
Central Union, Bonds, 5's.	3,000,000	1,000	110	112
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	310	325
Municipal Bonds	750,000	..	..	
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	112½	113
Northern Union, Bonds, 5's.	1,250,000	1,000	108	110
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	109	111
Standard	5,000,000	100	131	..
Preferred	5,000,000	100	132	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	115½	118
Yonkers	299,650	500	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	220	226
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	⅝	9/16
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works,..	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	7½	10
" " Bonds, 5's	5,256,000	1,000	75	77
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central San Francisco	900,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co..	29,500,000	100	99½	100
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¾	89¼
Preferred	3,026,500	100	107½	109
Consumers, Jersey City Bonds	600,000	1,000	103	106
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore...	11,000,000	100	71	71¼
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	86	87
Consolidated G. & E. Co.'s.				
Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	382,000	1,000	77	79
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	..	68½
" Bonds, 6's	2,650,000	..	102	105
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	80	85
Preferred	2,500,000	100	95	100
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	130	140
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	106¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	300	325
Nashville Gas Lt. Co.	1,000,000	100	110	..
Oakland, Cal.	2,000,000	..	46	46
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	106¾	107
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	41½	42½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's.	650,000	1,000	113	116
Extension, 6's.	600,000	1,000	112½	115
General Mortgage, 5's..	2,465,000	1,000	92	93
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	95	96¼
Syracuse, N. Y.	1,975,000	100	29	..
Bonds	2,047.000	1,000	99¼	100
Washington, D. C	2,600,000	20	410	415
First mortgage 6's	600,000	..	..	..
Western, Milwaukee.				
Bonds, 5's	4,000,000	..	109½	110
Wilmington, Del.	600,000	50	232	..

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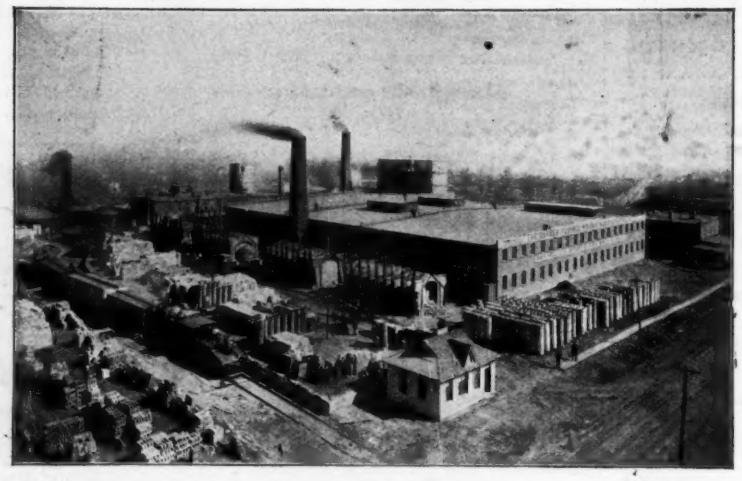

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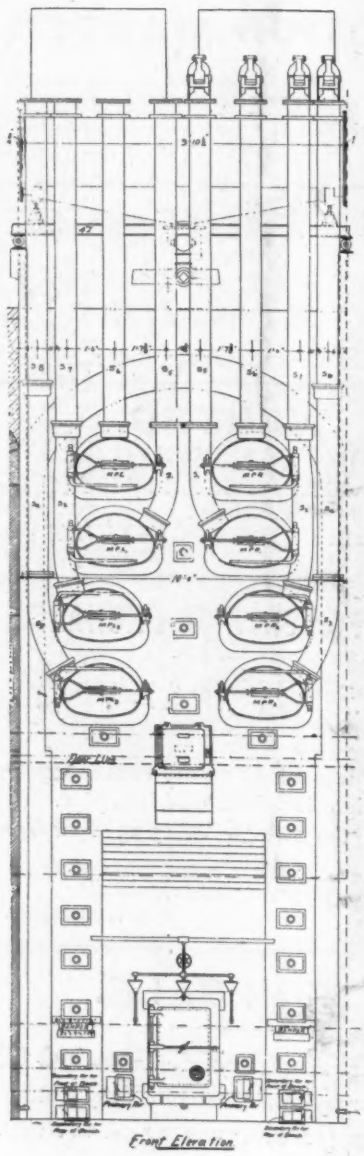

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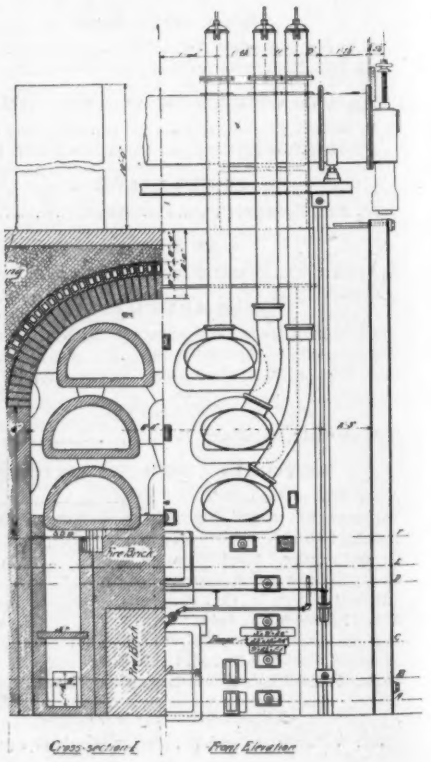

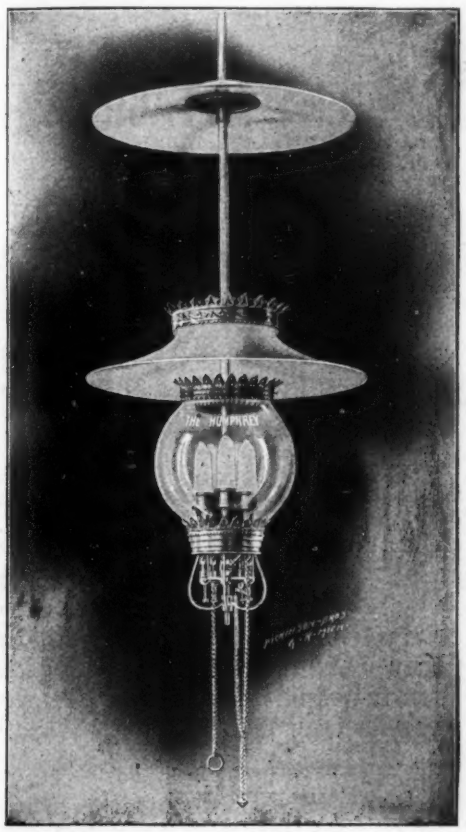

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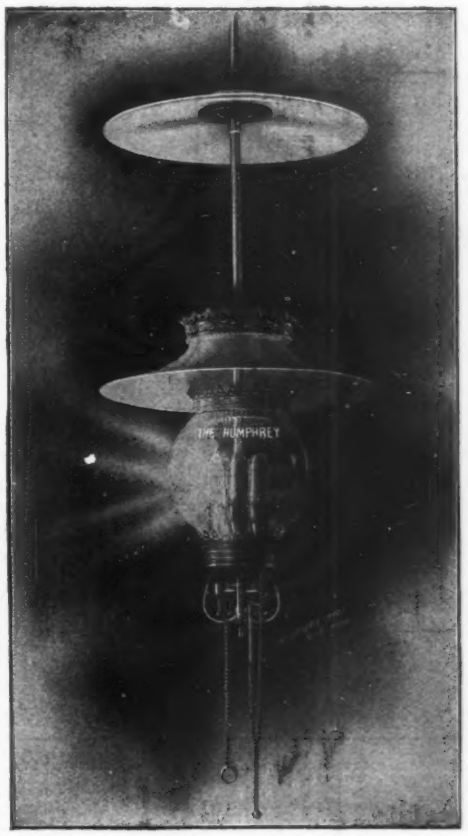

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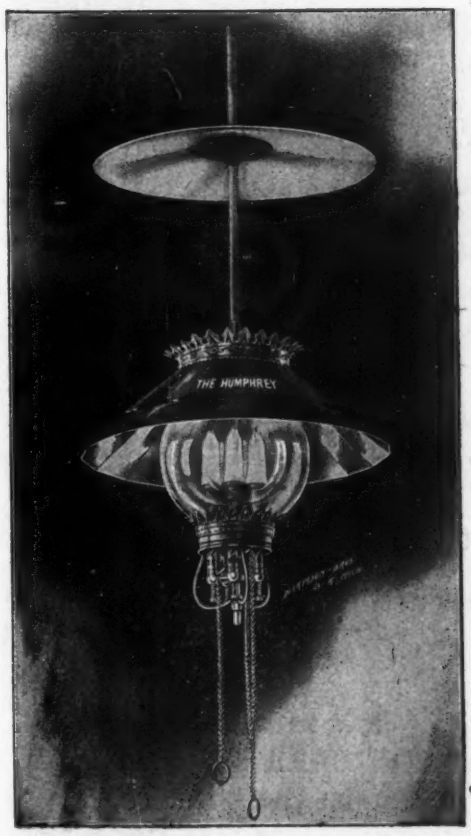

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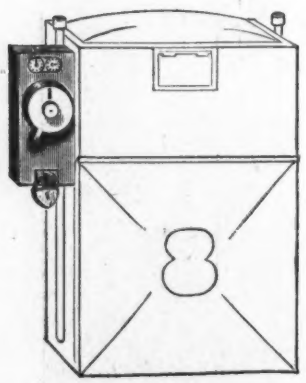

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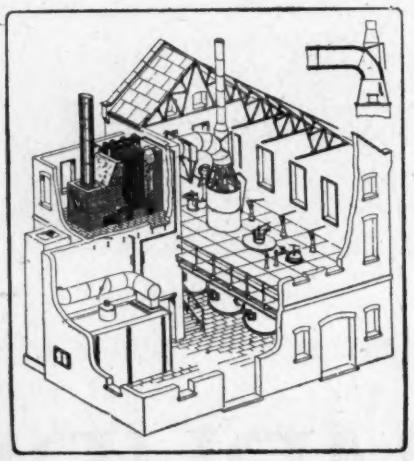

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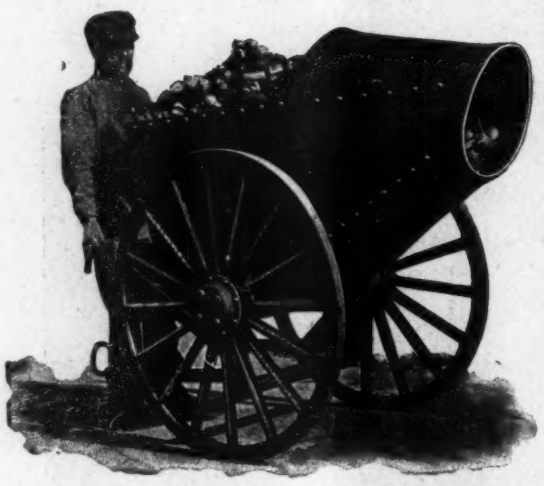

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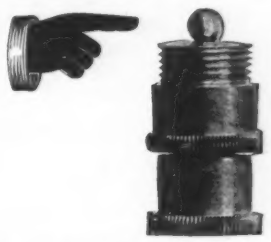

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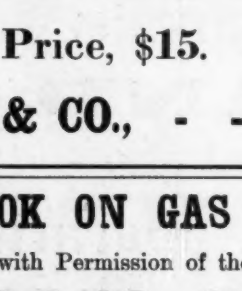

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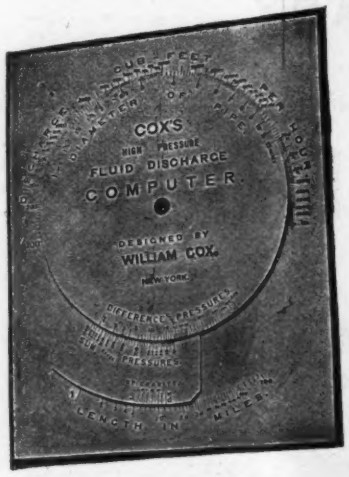

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This Computer solves the following formula, which is applicable to Gas, Air and other elastic fluids, flowing through long pipes with high initial pressures:

$$\text{Discharge in cubic feet per hour at atmospheric pressure} = 33.3\sqrt{\frac{d^5 \times (p_1^2 - p_2^2)}{L \times w}}$$

Where d = diameter of pipe in inches,
p_1 = absolute initial pressure in pounds per square inch,
p_2 = absolute terminal pressure in pounds per square inch,
L = length of pipe in miles,
w = specific gravity of the fluid when air = 1.

To Find the Discharge from a Pipe and the Required Size of Pipe.

(1.) Set the specific gravity of the fluid opposite the length of pipe;
(2.) Bring the DIFFERENCE of the initial and terminal gauge pressures opposite the SUM of the initial and terminal gauge pressures;
(3.) Opposite any diameter of pipe will now be found the discharge in cubic feet per hour at atmospheric pressure; and
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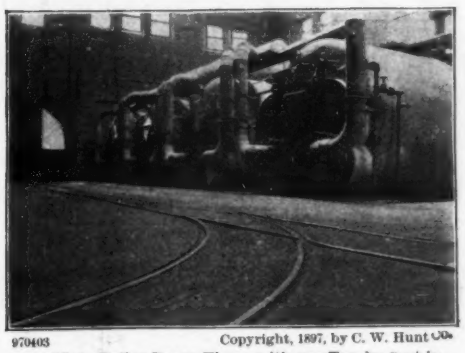

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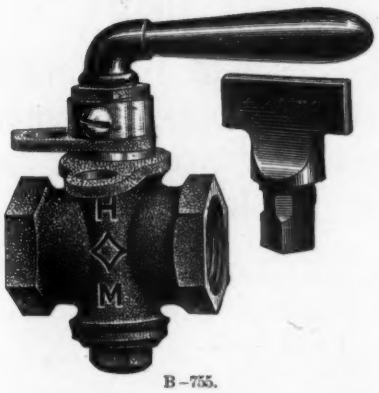

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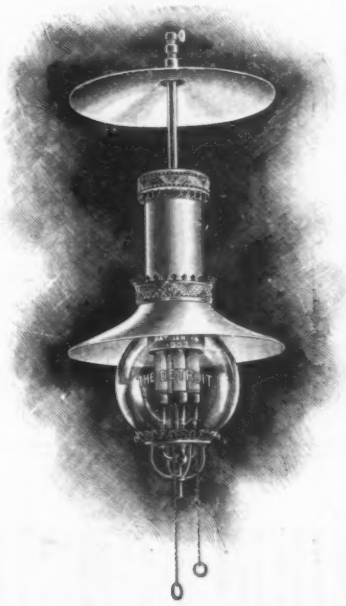

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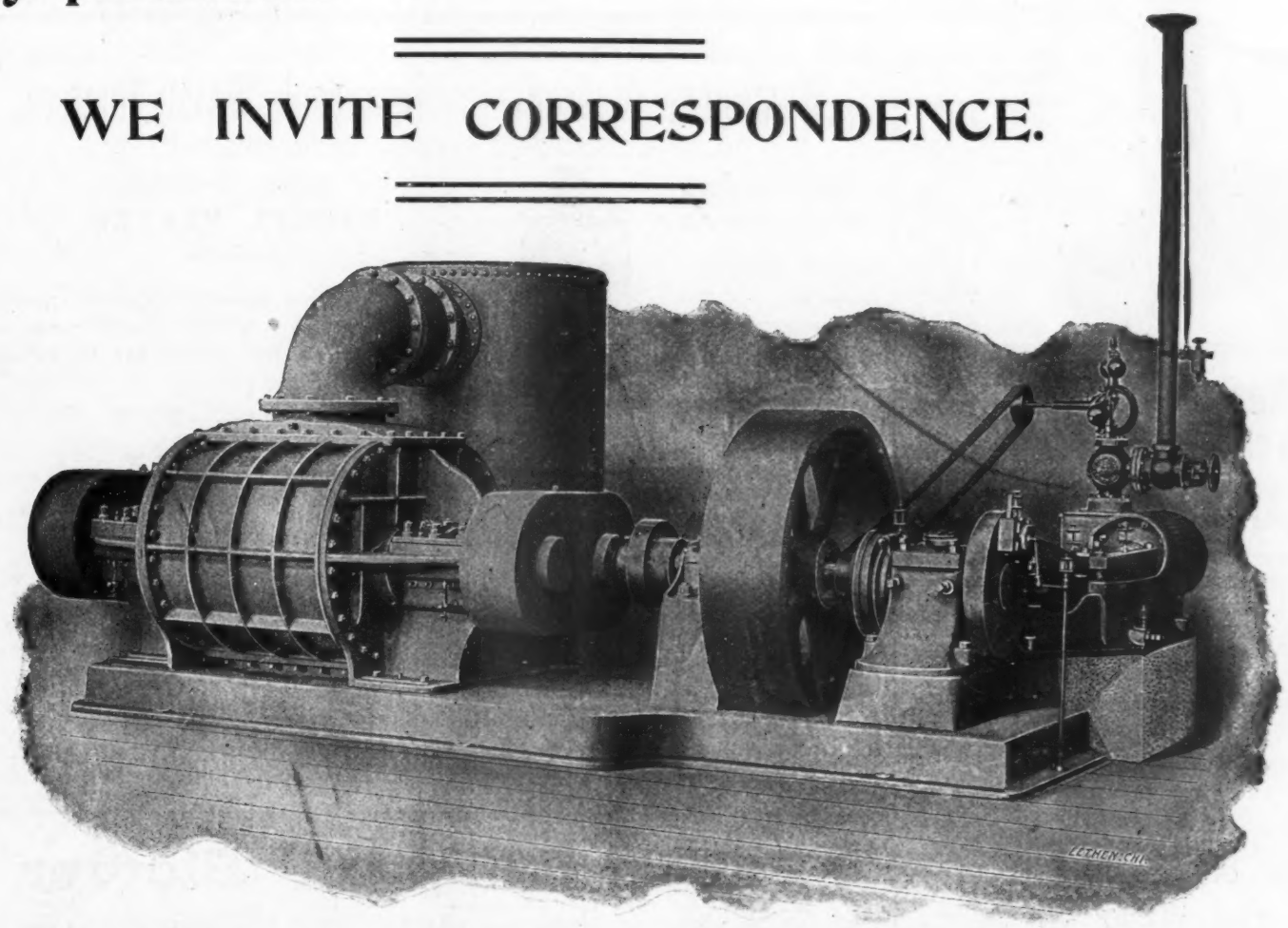

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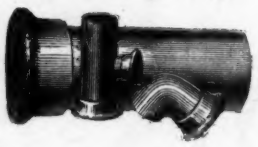

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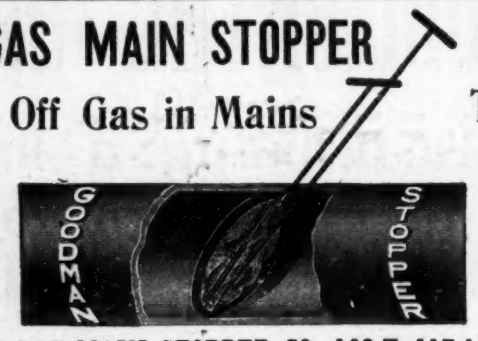

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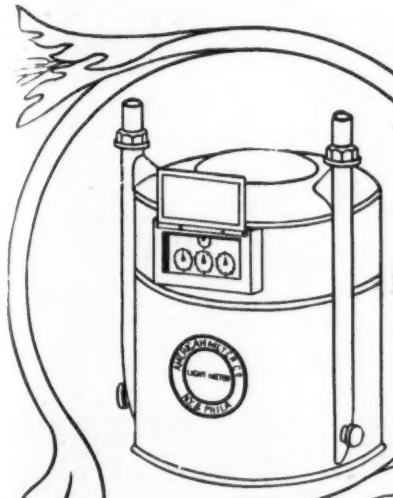
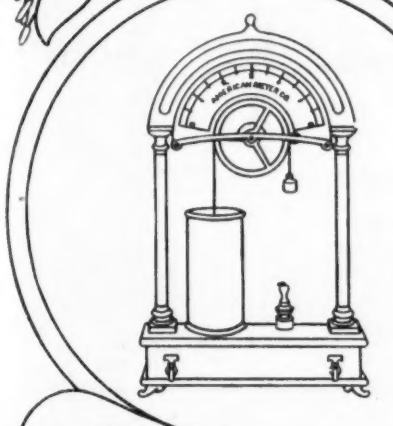
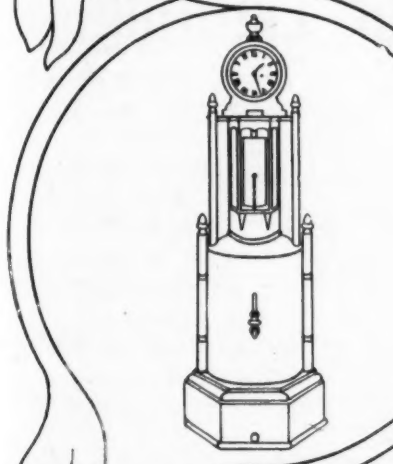






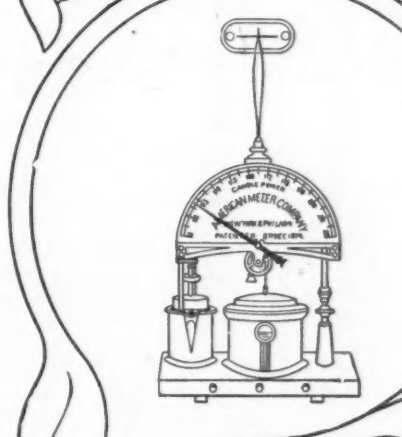
PUBLIC LIGHTING TABLE.

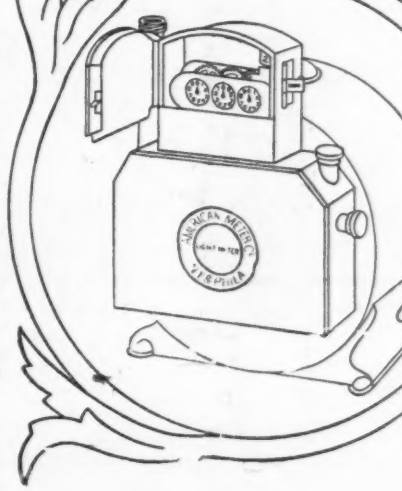
MARCH, 1903.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light. P.M.	Table No. 2. New York City. All Night Lighting. Extinguish. A.M.
Sun.	1	6.20 PM	5.30 AM	5.30	5.45
Mon.	2	6.20	5.30	5.30	5.45
Tue.	3	9.30	5.30	5.30	5.45
Wed.	4	10.30	5.30	5.30	5.45
Thu.	5	11.30	5.30	5.40	5.35
Fri.	6	12.30 AM FM	5.30	5.40	5.35
Sat.	7	1.30	5.30	5.40	5.35
Sun.	8	2.20	5.20	5.40	5.35
Mon.	9	3.10	5.20	5.40	5.35
Tue.	10	3.50	5.20	5.40	5.35
Wed.	11	No L.	No L.	5.40	5.35
Thu.	12	No L. FM	No L.	5.50	5.20
Fri.	13	No L.	No L.	5.50	5.20
Sat.	14	6.40 PM	8.40 PM	5.50	5.20
Sun.	15	6.40	9.40	5.50	5.20
Mon.	16	6.40	10.40	5.50	5.20
Tue.	17	6.40	11.40	5.50	5.20
Wed.	18	6.40	12.40 AM	5.50	5.20
Thu.	19	6.40	1.30	6.00	5.10
Fri.	20	6.40 LQ	2.20	6.00	5.10
Sat.	21	6.40	3.00	6.00	5.10
Sun.	22	6.50	3.40	6.00	5.10
Mon.	23	6.50	4.20	6.00	5.10
Tue.	24	6.50	5.00	6.00	5.10
Wed.	25	6.50	5.00	6.00	5.10
Thu.	26	6.50	5.00	6.10	4.55
Fri.	27	6.50	5.00	6.10	4.55
Sat.	28	6.50 NM	5.00	6.10	4.55
Sun.	29	6.50	4.50	6.10	4.55
Mon.	30	6.50	4.50	6.10	4.55
Tue.	31	6.50	4.50	6.10	4 55

TOTAL HOURS LIGHTING DURING 1903.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	245.00	January	423.20
February	192.00	February	355.25
March	201.00	March	355.35
April	167.20	April	298.50
May	152.00	May	264.50
June	131.00	June	234.25
July	140.40	July	243.45
August	156.20	August	280.25
September	171.20	September	321.15
October	198.20	October	374.30
November	216.30	November	401.40
December	232.10	December	433.45
Total, yr.	2203.40	Total, yr.	3987.45





NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

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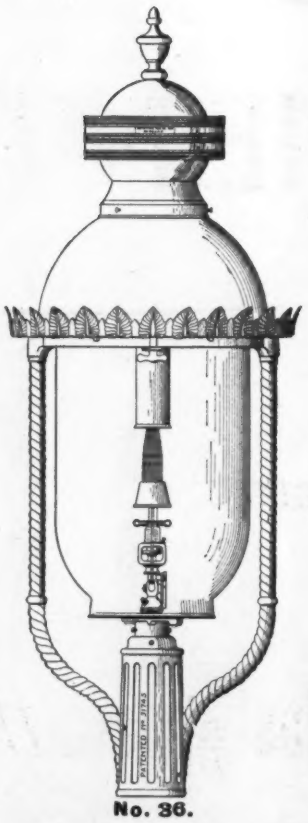
.... OF AMERICA ....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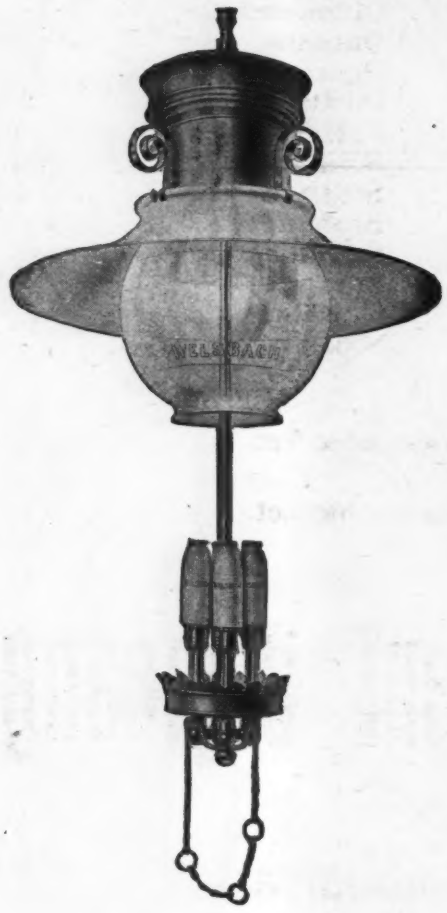

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TOTAL SETS, 1902, ... 51
TOTAL DAILY CAPACITY, 1902, . . 32,825,000 cubic feet.
TOTAL SETS TO DATE, ... 447
TOTAL DAILY CAPACITY, ... 299,670,000 cubic feet.

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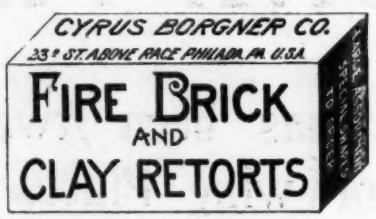

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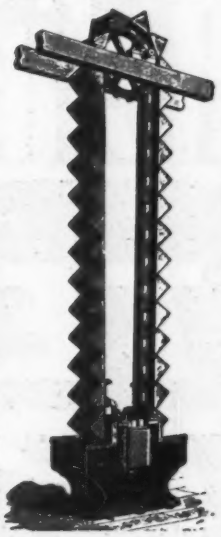

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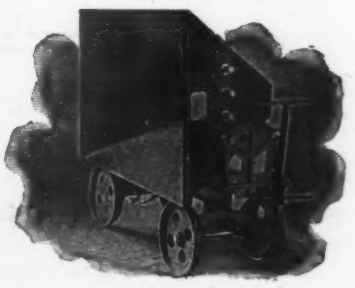

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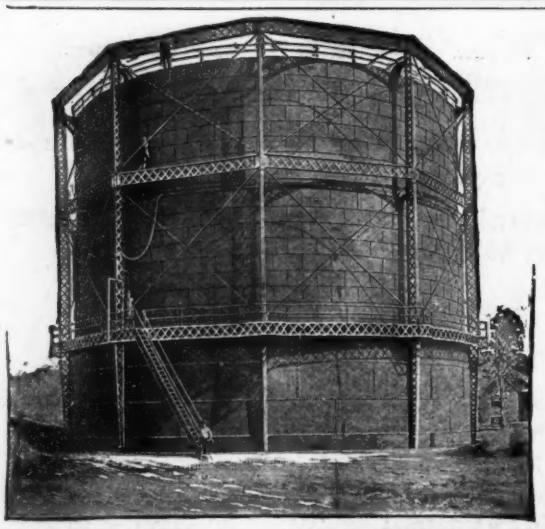

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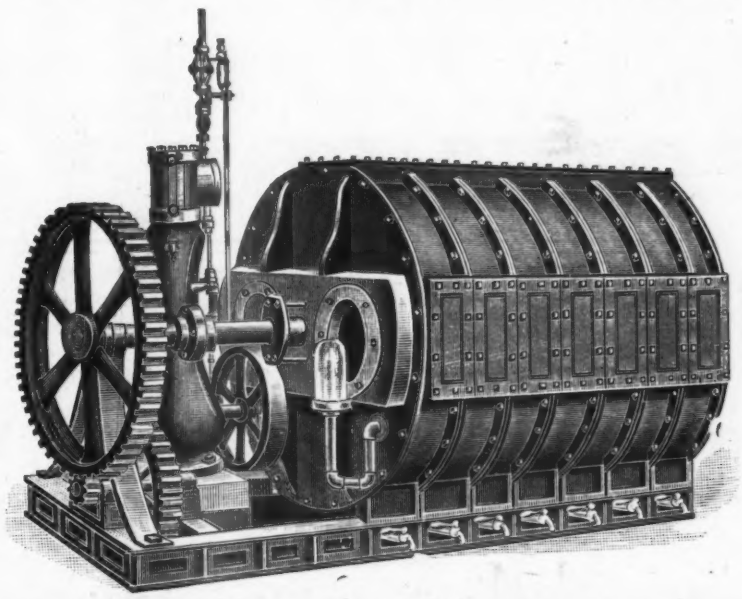

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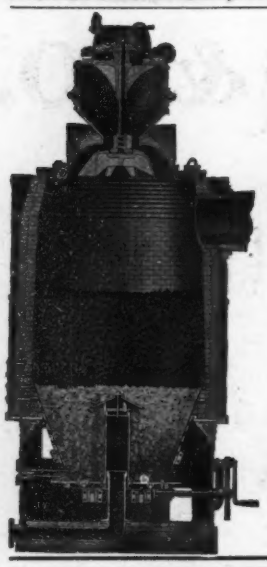

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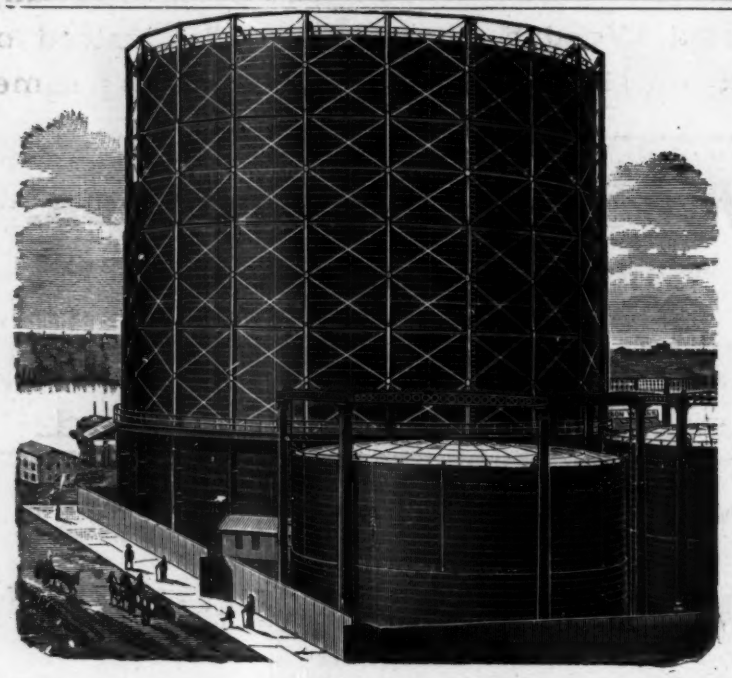

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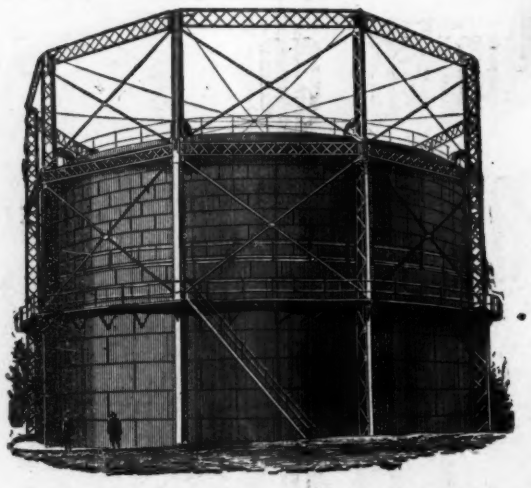

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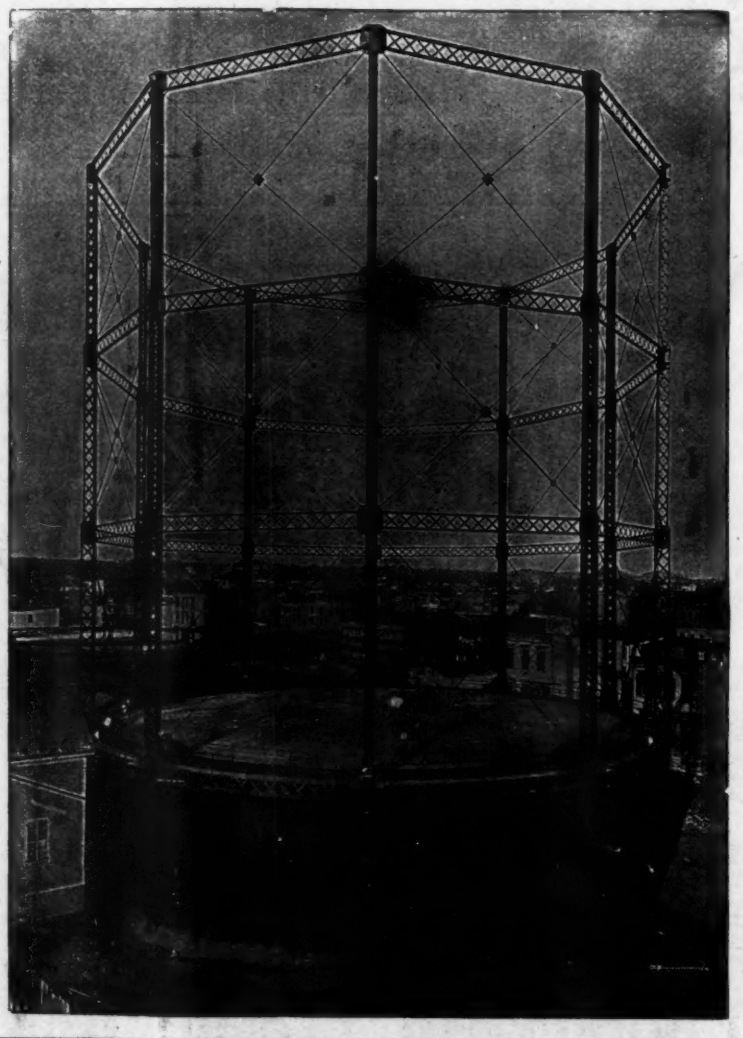

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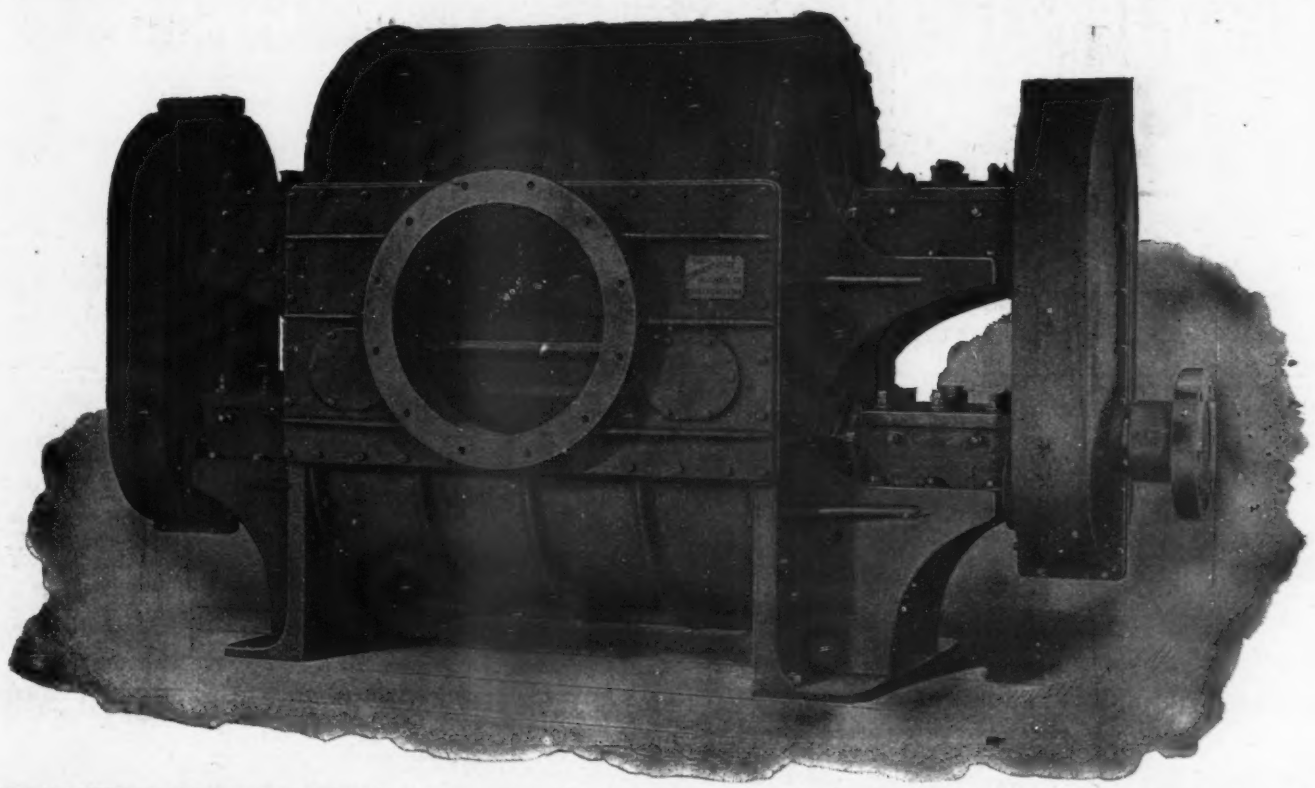

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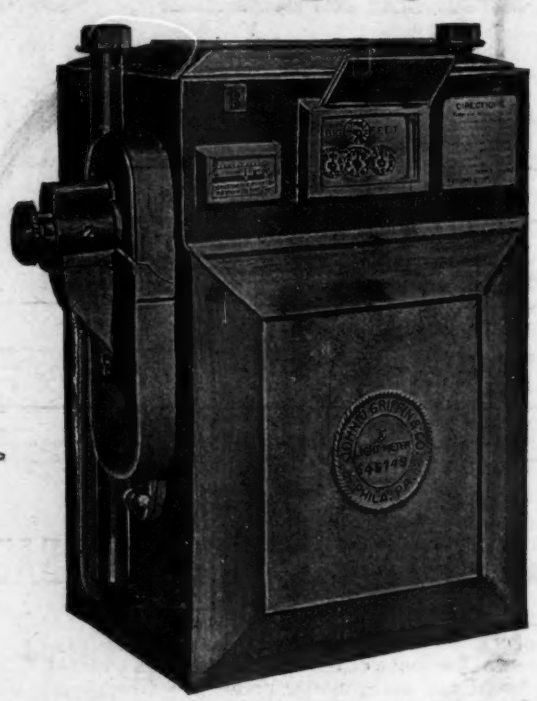

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